DISSERTATION ON
MORPHOLOGICAL STUDY OF CAECUM AND VERMIFORMAPPENDIX IN ADULT HUMAN CADAVERS

Submitted in partial fulfillment for

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MAY-2018

CERTIFICATE

This is to certify that this dissertation entitled **"MORPHOLOGICAL STUDY OF CAECUM AND VERMIFORM APPENDIX IN ADULT HUMAN CADAVERS"** is a bonafide record of the research work done by **Dr.K.LAVANYA DEVI**, Post graduate student in the Institute of Anatomy, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai-03, in partial fulfillment of the regulations laid down by The Tamil Nadu Dr.M.G.R. Medical University for the award of M.D. Degree Branch XXIII-Anatomy, under my guidance and supervision during the academic year from 2015-2018.

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CERTIFICATE OF APPROVAL

To
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Dear Dr.K.Lavanya Devi,

The Institutional Ethics Committee has considered your request and approved your study titled **"MORPHOLOGICAL STUDY OF CAECUM AND VERMIFORM APPENDIX IN ADULT HUMAN CADAVERS" NO. 24072016.**

The following members of Ethics Committee were present in the meeting hold on **05.07.2016** conducted at Madras Medical College, Chennai 3

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We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

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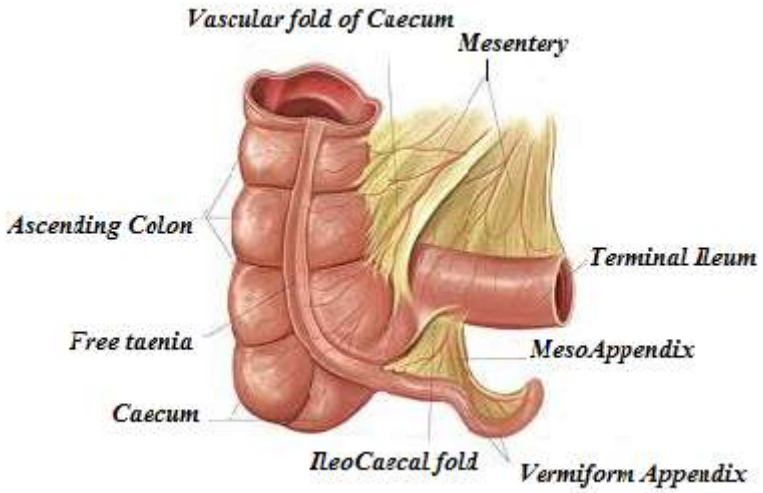
ABBREVIATIONS

VA	Vermiform Appendix
SMA	Superior Mesenteric Artery
ICA	Ileo Colic Artery
ACA	Anterior Caecal Artery
PCA	Posterior Caecal Artery
AA	Appendicular Artery
AAA	Accessary Appenicular Artery
MA	Meso Appendix
RIF	Right Iliac Fossa
LIF	Left Iliac Fossa
ICJ	Ilio Caecal Junction
ICO	Ilio Caecal orifice
APO	Appendicuar Orifice

CONTENTS

INTRODUCTION

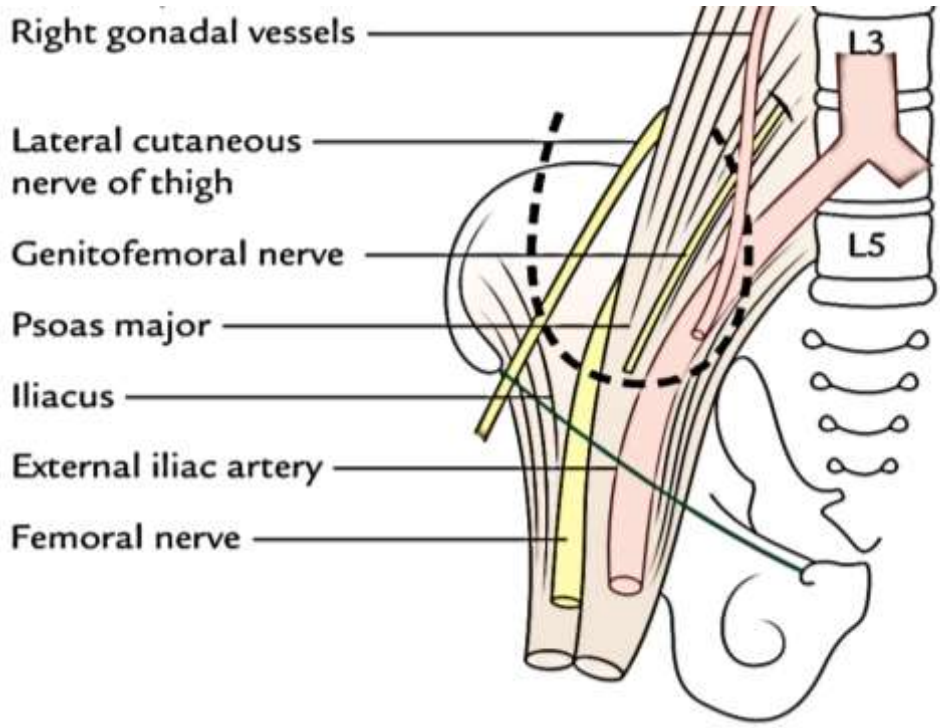
Caecum (Intestinum Crassum Caecum) is the commencement of large intestine. It is located in the Right Iliac Fossa (RIF). It is a large cul-de-sac continuing superiorly as the ascending colon where the ileum opens into the large intestine from the medial side. Caecum is situated in the triangular area between the inguinal ligament below and the two planes above namely, the right lateral and trans-tubercular planes.



Caecum and Vermiform Appendix

The average axial length of the Caecum is about 6 cms and the width is about 7.5 cms. The width of the Caecum is greater than its length. In the right iliac fossa it is superior to the lateral half of the inguinal ligament and it rests on the right iliacus and psoas major which forms the posterior relation of the Caecum. The Caecum is separated from both the muscles by their covering fascia and peritoneum. The

following structures are intervening between the posterior surface of the Caecum and these two muscles which include the genitofemoral nerve, lateral cutaneous nerve of thigh, femoral nerve and the gonadal vessels. The Caecum frequently overlaps the external iliac artery, and being relatively mobile, may lie in the lesser pelvis. The retrocaecal recess, which lies posterior to the Caecum frequently contains the Vermiform Appendix (VA).



Posterior Relations of the Caecum

Anteriorly, the Caecum is usually in contact with the anterior abdominal wall, the greater omentum and some coils of small intestine may be interposed if the Caecum is empty. The Caecum is completely covered with peritoneum but sometimes when the peritoneum covering

the Caecum is incomplete, the superior part of the posterior surface is uncovered and it is connected to the iliac fascia by areolar tissue.

In the large intestine, longitudinal muscle layer is condensed to form three bands namely taenia libera, taenia mesocolica and taenia omentalis. The taenia libera is anterior, taenia mesocolica is postero medial and taenia omentalis is postero lateral to the caecum these bands are shorter than the other intestinal layers, thus producing puckering or haustrations or sacculations on the caecum.

CAECAL RECESSES

Peritoneal folds (recesses) related to the caecum are known as Caecal receses.

Superior Ileocaecal Recess

It is bounded anteriorly by the vascular fold of Caecum containing the anterior caecal artery and its vein, posteriorly by the ileal mesentery, inferiorly by the terminal ileum and on to the right by the ileocaecal junction. Its orifice opens downwards towards the left. It is usually present and best developed in chidren and obliterated in adults.

Inferior Ileocaecal Recess:

It is present beneath the inferior ileocaecal fold. This fold extends from the antero-inferior aspect of the terminal ileum to front of the mesoappendix (or to the appendix or caecum). This fold does not

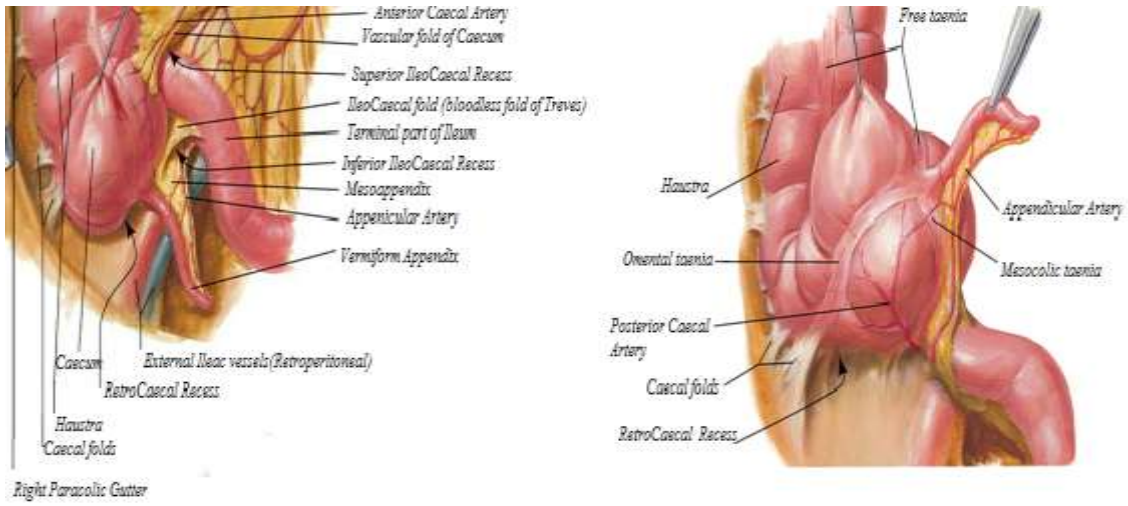
contain any bloodvessel , hence referred to as the **‘‘bloodless fold of Treves’’**.

This recess is bounded anteriorly by the inferior ileocaecal fold, posteriorly by the mesoappendix, superiorly by the posterior ileal surface and its mesentry on the right by the Caecum. Its orifice opens downwards towards the left.

RetroCaecal Recess

It is situated behind the Caecum and it varies in size and its extent. Sometimes it may extend behind the proximal part of the ascending colon.

It is bounded anteriorly by the Caecum, posteriorly by the parietal peritoneum and on each sides by the Caecal folds (parietocaecal folds) passing from the Caecum to the posterior abdominal wall. The Vermiform Appendix frequently occupy this recess.



Caecal Recess and Retrocaecal Recess Exposed

VARIATIONS IN THE CAECUM

Depending on the shape, four types of Caecum are described:

Conical type (Foetal type)

In the early foetal life, the Caecum is short, conical and broad based, with the apex turned superomedially towards the ileocaecal junction. As the foetus grows, the Caecum increases initially in length more than its breadth, still the apex lies superomedially and maintains the same inclination. In the later stages of intrauterine period the proximal part of the Caecum widens and the growth in the distal part ceases, as a result the Vermiform Appendix extends from the apex of the conical Caecum. The foetal type may persist in a few cases of adults. The three taenia coli start from the base of the Vermiform Appendix and are at equal distance from each other.

Quadrate type (Infantile type)

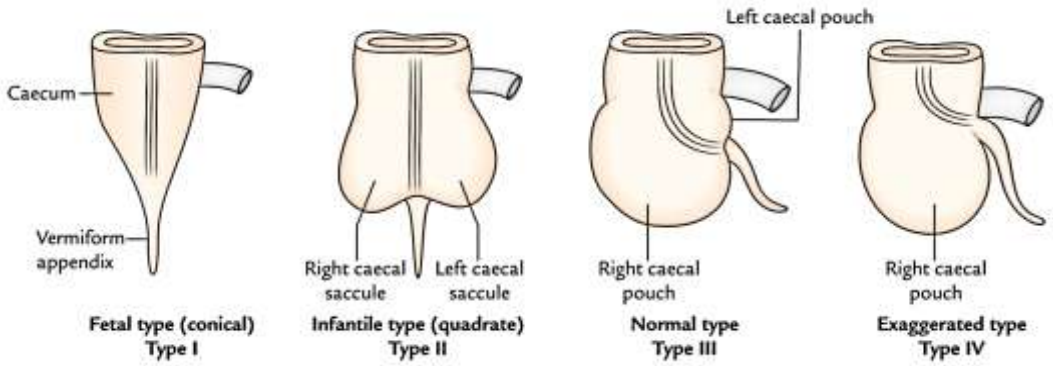
In this type, the conical Caecum becomes quadrate in shape as a result of outgrowth of both right and left saccules on either side of the anterior taenia, the saccules are of equal in size and the Vermiform Appendix arises from the depression between them.

Ampullary type (Normal type)

This is the commonest form. The right saccule grows more rapidly than the left pushing the apex of the Caecum and Appendix towards the ileocaecal junction.

Asymmetrical type (Exaggerated type)

This is the rare type where the right saccule grows further and left saccule is atrophied. So the original apex of the Caecum and the appendix are close to the ileocaecal junction, and the anterior taeniacoli is also turned medially.



Variations in Caecum

INTERIOR OF THE CAECUM

The interior of the Caecum has two orifices – IleoCaecal Orifice (ICO) and Appendicular Orifice (APO).

IleoCaecal Orifice (ICO)

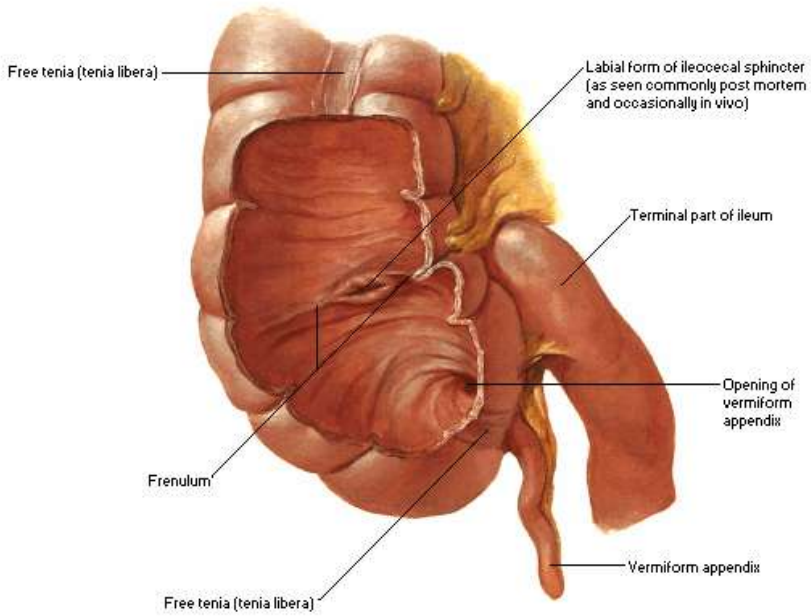
The IleoCaecal Orifice is situated in the posteromedial wall of the Caecum at its junction with ascending colon, and it corresponds with the intersection between transtubercular and right lateral planes. It measures about 2.5 cms transversely. This orifice is guarded by a valve known as ileocaecal valve. The valve has two flaps projecting into the lumen of the large intestine namely the ileocolic or superior flap and the ileocaecal or inferior flap. Both the flaps coalesce at their ends,

continuing as narrow membranous ridges, known as frenula of the ileocaecal valve.

The valve has an ileal surface and a caecal surface. The ileal surface is provided with villi , whereas the caecal surface is devoid of villi but display numerous orifices of tubular glands. This valve not only prevents reflux of the contents from the Caecum to the ileum but it also prevents the contents of the ileum passing too quickly into the Caecum.

Appendicular Orifice (APO)

It is a small circular opening situated about 2.5 cms below and behind the ileocaecal orifice. This orifice is guarded by a semilunar mucosal fold known as **'valve of Gerlac'**.



Interior of the Caecum

VERMIFORM APPENDIX (VA)

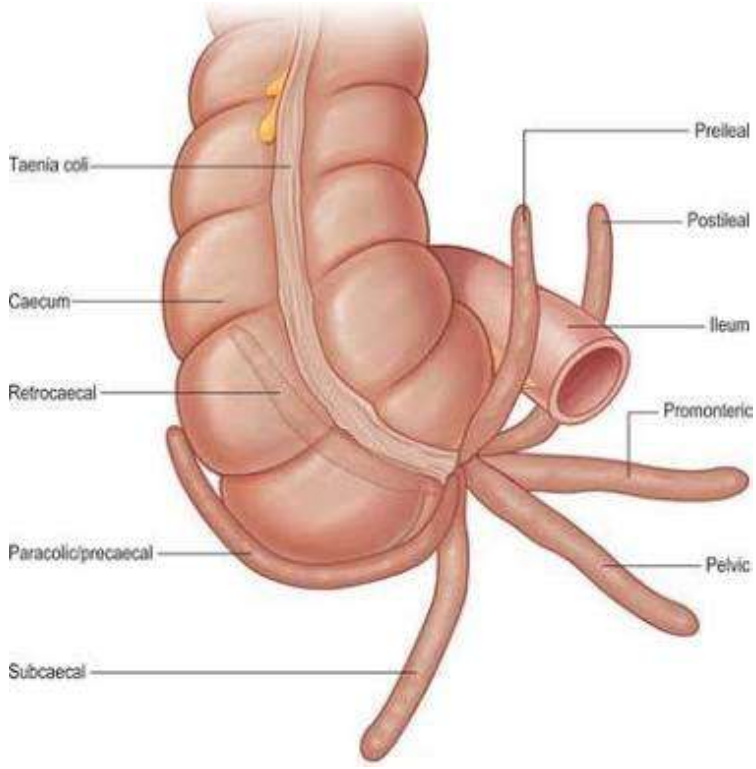
The Vermiform Appendix (L. Appendere– to hang on) is a narrow vermian tube arising from the posteromedial wall of the Caecum, about 2 cms below and behind the terminal end of ileum. The length of the Vermiform Appendix varies from 2 to 20 cms with an average of about 9 cms. The external diameter (EDM) varies between 3 to 8 mms, whereas the luminal diameter varies between 1 and 3 mms. The canal of the appendix is small and opens into the Caecum through the appendicular orifice guarded by valve. The lumen is relatively wide in infants and it partially or completely obliterated in the later decades of life.

The parts of the vermiform appendix are base, body and tip. The base opens into the posteromedial part of the Caecum, where all the three taeniae converge. The anterior taenia coli is distinct and can be traced up to the base of the appendix, which is an useful guide to identify the appendix. The tip is the free blunt end of the appendix. The attachment of the base is constant whereas the position of the tip is inconstant. It can be found in any one of the following positions. Frequently it lies in the retrocaecal recess, but may extend into the lesser pelvis to lie close to the ovary, uterine tube and ureter.

- Retrocaecal and Retrocolic (12 o'clock position) - the appendix is directed upwards and lying in the retrocaecal recess (Retrocaecal). If the length of the appendix is greater and it extends behind the

proximal part of the ascending colon (Retrocolic). This is commonest position of the Vermiform appendix.

- Subcaecal (6 o'clock position) - the appendix lies below the Caecum.
- Right paracaecal (11 o'clock position) - the appendix lies on the right side of Caecum.
- Left paracaecal (1 o'clock position) - the appendix lies on the left side of Caecum. It may be preileal, when the appendix lies anterior to the terminal ileum or post ileal, when it lies posterior to the terminal ileum in relation to the anterior abdominal wall.
- Pelvic (4 or 5 o' clock position) - the appendix crosses the pelvic brim and lies on the true pelvis.
- Promonteric (3 o'clock position) -the appendix is directed towards the sacral promontory.
- Midinguinal (6 o'clock position) -the appendix is facing downwards towards the inguinal ligament.
- Splenic (2 o'clock position) - the appendix is directed towards the spleen.
- Ectopic - it may be situated in the left iliac fossa, umbilical or the subhepatic regions (due to the errors of mid-gut rotation).



Various Positions of the Vermiform Appendix

MESOAPPENDIX (MA):

This is a triangular fold of peritoneum around the appendix, attached to the back of lower end of mesentery close to the ileocaecal junction. It extends almost upto the tip of the appendix but sometimes fails to reach the distal third. Unlike other mesenteries, the mesoappendix (Mesenteriolum) is not attached to the posterior abdominal wall but it is attached to the mesentery of the terminal part of the ileum. It encloses the blood vessels, nerves, lymphatics of appendix.

BLOOD SUPPLY OF CAECUM AND APPENDIX

Arterial supply

The Caecum and appendix are supplied by the ileocolic artery (ICA).

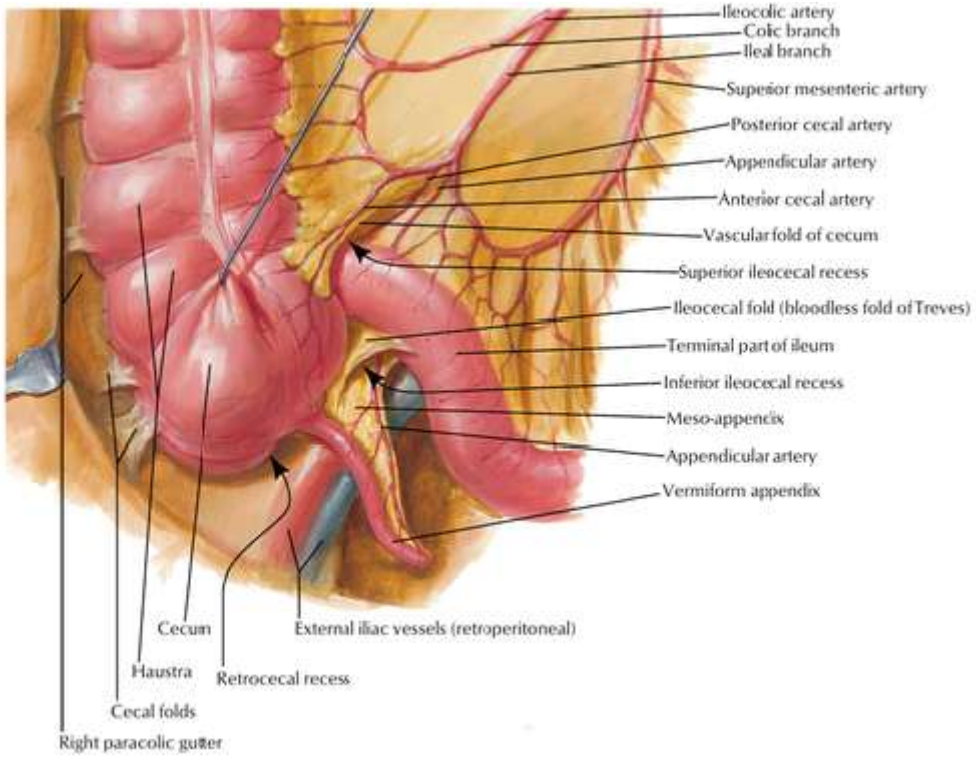
The ileocolic artery, a branch from the superior mesenteric artery (SMA) descends to the right side under the parietal peritoneum to the right iliac fossa, where it divides into superior and inferior branches. The superior branch anastomose with the right colic artery (RCA).

The inferior branch approaches the superior border of the ileocolic junction and divides into Ascending (colic) branch, Anterior caecal branch (ACA), Posterior caecal branch (PCA), and Ileal branches.

The colic branch, passes upwards on the ascending colon. The Anterior caecal branch supplies the anterior surface of the Caecum.

The Posterior caecal branch supplying the posterior surface of the Caecum and sometimes the appendix, and the Appendicular artery(AA) supplies appendix and ileal branches supplies the terminal ileum.

The appendicular artery passes behind the terminal part of the ileum and traverses in the mesoappendix from the base of the appendix towards its tip. At the base it gives a recurrent branch which anastomoses with the posterior caecal artery. The appendicular artery is said to be an end artery, and the tip of the appendix is least vascular. In case of obstruction of the artery, it leads to the gangrenous change in the tip. Accessory appendicular artery (AAA) (Artery of Seshachalam) may arise from the posterior caecal artery or from the superior division of ileocolic artery or from the ileocolic artery.



Blood supply of the Caecum and Vermiform Appendix

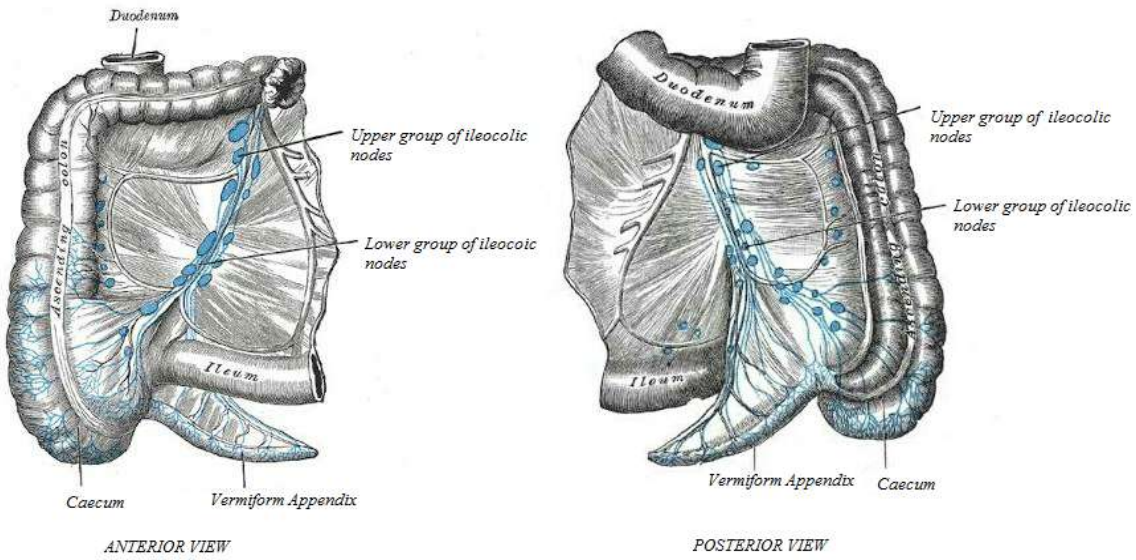
VENOUS DRAINAGE

The tributaries from the Caecum and Vermiform Appendix drains into the ileocolic vein which in turn drains into the superior mesenteric vein.

LYMPHATIC DRAINAGE OF CAECUM AND APPENDIX

Lymphatics of Caecum and appendix are numerous since lymphoid tissue is abundant in their walls. The anterior vessels from the Caecum and the base of the appendix passes in front of the Caecum to the anterior ileocolic nodes and the upper and lower nodes of ileocolic chains. The posterior vessels from the Caecum and the base of the appendix ascend over the back of Caecum to the posterior ileocolic nodes and lower group of ileocolic chain. From the body and the tip of

the appendix, 8 to 15 vessels ascend in the mesoappendix and unite to form 3 or 4 vessels ending in the upper and lower nodes of ileocolic chain.



Lymphatic Drainage of the Caecum and Veriform Appendix

NERVE SUPPY OF CAECUM AND APPENDIX

Innervation of Caecum and appendix includes both intrinsic component and extrinsic component

Intrinsic component

It consists of Myenteric (Auerbach's) nerve plexus and the submucosal plexus

Myenteric plexus lies between the inner circular and outer longitudinal layers of the muscularis externa.

The submucosal plexus is divisible into deep submucosal plexus (of Schabadasch/of Henle) and superficial submucosal plexus (of Meissner). The deep plexus is situated near the submucosal surface of the muscularis externa and the superficial plexus is situated near the submucosal surface of muscularis mucosa.

The intrinsic innervation formed by these plexus are mainly responsible for the intestinal contractions that occur at the time of total absence of the extrinsic innervation.

Extrinsic component

It includes both the sympathetic innervation and parasympathetic innervation which exerts regulatory influences upon the intrinsic component and receives reflex mediated afferent fibres from the visceral sensory nerves.

Sympathetic innervation

It is through the superior mesenteric plexus and the preganglionic fibres from the T10 to L1 segments (thoracolumbar outflow) of the spinal cord. Mainly motor to the ileocaecal sphincter but inhibitory to the muscles of the caecum and appendix. In addition they are vasomotor. The appendix is innervated by the preganglionic fibres of the T10 segment of the spinal cord. This explains the referred pain in case of appendicitis to the umbilical region which is distributed along the dermatomes of T10 spinal segment.

Parasympathetic innervation

The parasympathetic fibres are derived from the splanchnic branches of both the vagi, supplies secretomotor fibres to the glands within the wall of the caecum and appendix and motor to the muscular coats but inhibitory to the ileocaecal sphincter.

Since the Caecum and proximal ascending colon share a common innervation with the appendix, the early stages of caecal inflammation results in similar visceral pain symptoms as those experienced in appendicular inflammation.

FUNCTIONS OF CAECUM AND VERMIFORM APPENDIX

CAECUM

It is the part of large intestine, its function is mainly absorption of fluid and solutes.

APPENDIX

Until recently it has been suggested the Vermiform Appendix is a vestigial organ without any known function. It is now believed the lumen of appendix houses bacterial bio film of colonies that represent the normal intestinal flora. In case of pathogenic invagination these colonies may have the capablity of restoring the normal bacterial flora, thus repairing the biological damage.

AIM OF THE STUDY

Vermiform Appendix (VA) has greater clinical importance since it is involved in different pathological conditions like appendicitis, carcinoma, carcinoid tumours and diverticulitis. The inflammation of the VA is known as appendicitis (epityphilitis). It is one of the most common cause of acute abdomen in young adults. It is rare in children below two years because of its anatomical characteristics and relation to the Caecum. It is one of the commonest clinical condition which requires emergency intervention.

Appendicitis in various positions of appendix may mimic different diseases. In retrocaecal appendicitis, the patient will have symptoms mimicking colitis or urinary tract infection because of the irritation of the adjacent ureter. In pelvic appendicitis, it may irritate the urinary bladder and rectum, resulting in pain in the suprapubic region, pain at the time of micturition and defaecation. The Post ileal appendicitis mimics ureteric colic in both the sexes, testicular pain in males and pelvic inflammatory disease, torsion ovarian cyst and rupture tubal pregnancies in females. The Subhepatic appendicitis may mimic biliary colic pain in the right hypochondral region. The knowledge of variations in the positions of Vermiform Appendix will be helpful to identify the site of origin of pain at the time of inflammation of appendix.

Appendicular artery (AA) being an end artery, any obstruction in the AA and incomplete MesoAppendix (MA) will lead to ultimate arterial compromise and gangrene formation as well as early perforation at the time of inflammation. However Accessory Appendicular Artery (AAA) will provide additional blood supply to the VA and reduces the possibility of gangrene formation in appendicitis.

Lymphatics travelling along the course of AAA have a great importance for oncosurgeons in treatment of the Appendicular tumours. Appendiceal carcinoid is the second most common disease of the VA with the incidence of 1 in 200 gastrointestinal malignancies. Primary Adenocarcinomas of the VA is extremely rare. Obstruction of the Appendicular Orifice (APO) by tumour particularly in carcinoma of the Caecum is a rare cause for acute appendicitis in middle aged and the elderly patients.

Catarrhal inflammation of the Caecal mucous membrane associated with habitual constipation is called typhilitis tercoralis. Perityphilitis is the inflammation of loose areolar tissue present between the Caecum and the fascia iliacus. It is mostly idiopathic in nature. Infections like typhus and tuberculosis of the Caecum may extend into the VA leading to perforation.

Rarely the Caecum does not migrate to the RIF during the embryological development leading to undescended Caecum along with

VA near the gall bladder and undersurface of the liver or in case of malrotation of the gut it may be in the LIF causing diagnostic difficulty, if appendicitis develops.

A thorough anatomical knowledge of the variations in the positions of the Caecum and VA and its blood supply will be helpful for the surgeons and the radiologists during surgical procedure and imaging techniques.

OBJECTIVES

- To study the variations in the position of Caecum, shape and its dimensions .
- To study the variations in the position of VA and its dimensions.
- To study the variations in the arterial supply of VA.
- To study the extent of MA.
- To study the distance between the ICO and the APO.

REVIEW OF LITERATURE

1. POSITION OF THE CAECUM

Smith 1911 [53] reported 31 cases of undescended Caecum in 1000 autopsy cases.

Black CE [9] **1912,** reported a case of displacement of colon, in which subhepatic Caecum with appendix were found to be in the RIF.

Vosburg AS [62] **1913**, reported a case of non rotation of small intestine, in which Caecum was found in the under surface of the liver.

Delatour B [14] **1915**, reported 3 cases of peristent embryonal types of large intestine,in which one found to be in sub hepatic Caecum.

Collins FK [12] **1928,** out of 9 cases of non malignant conditions of large intestine, he found a case of transposition of abdominal viscera with caecum in the LIF.

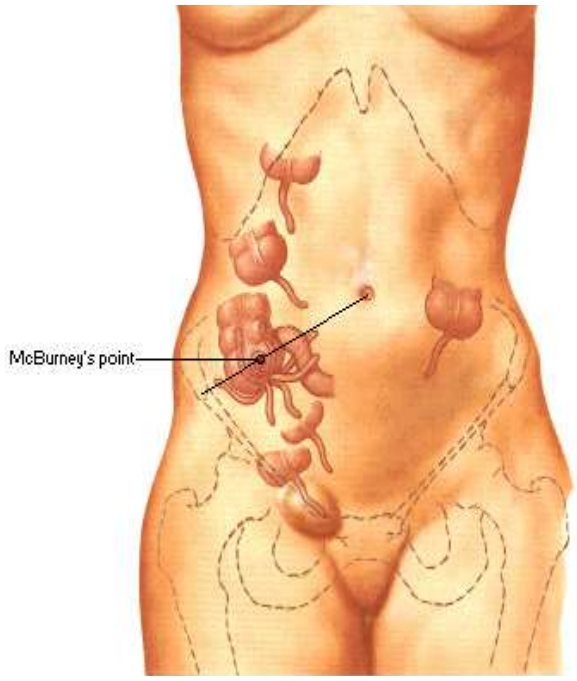
Nagarathnam et al [32] **1957**, reported a case of situs inversus with dextrocardia where they found the Caecum was in the LIF.

Griffith TW 1981 [22], reported a case of situs inversus totalis, where the Caecum was found to be in the LIF.

Akilandeswari Balasubramanian et al [3] in 2013, reported a case of undescended Caecum , in the right lumbar region during routine cadaveric dissection in a 60 year old female cadaver.

Nagashree M V et al [33] in 2013, reported a case of undescended subhepatic Caecum, during routine cadaveric dissection in male cadaver.

Sivanageswara Rao et al [52] 2013, studied the position of Caecum and VA in 40 adult cadavers and 50 dead foetuses. In adults, the Caecum was present in the RIF in all cases. In foetuses, 76% of the Caecum was located in the lumbar region, 20% in the sub hepatic and 4% in the RIF.



Various positions of Caecum and Vermiform Appendix

Garima Seghal et al [47] 2015, reported a case of malrotation of midgut in which the Caecum and VA was lying in the subhepatic region in a male cadaver during routine dissection.

Naveena Swargam et al [34] 2015, studied 50 specimens and found a majority lying in the RIF in 94%, remaining 4% cases it was in the subhepatic region, in 2% of the specimens it was in the LIF.

Sunnappu et al [58] 2015, studied adult Ileocaecal region in 50 cadavers, observed 100% of the Caecum was found to be in the RIF, in Andhra Pradesh.

2. SHAPE OF THE CAECUM

Treves [19] in 1885, classified the shape of the Caecum into four types. The adult (ampullary) type of Caecum was seen in majority of the cases (90 %), followed by the exaggerated type in about 4%, the quadrate type in about 3 % and the infantile type of Caecum was found in about 2 % of the Caecum (11 cadavers).

Griffith TW [22] 1981, reported a case of Situs inversus totalis in which the Caecum was cone shaped.

Arindom Banergee et al [4] 2012, studied the variations in Caecum and VA in 25 cadavers, found 88% was adult type, and 8% was exaggerated and 2% was conical in type in Andhra Pradesh.

Akilandeswari Balasubramanian [3] et al in 2103, reported a case of undescended Caecum, it was conical in shape in a 60 year old female cadaver in Bangalore.

Sivanageswara Rao et al [52] 2013, conducted a study in Andhrapradesh and found adult type of Caecum in all 40 adult cadavers (100%) . In 50 dead fetuses, the shape of the Caecum was found to be foetal type in 84%, adult type in 14% and in 2%, it was quadrate in type.

Nilesh Ashok Salwe et al [36] 2014, found that the most common shape of Caecum was adult type in 73.4 % cases, exaggerated type in 13.4%, infantile type in 8.2% and foetal type in 5% of cases in 60 cadavers in Western Maharashtra region.

Garima Seghal et al [47] in 2015, reported a case of malrotation of midgut in which the Caecum was found to be in quadrate shape, in a male cadaver during routine dissection in Lucknow.

Sunnappu et al [58] 2015, studied the adult ileocaecal region in 50 cadavers an observed 100% of the Caecum was found to be in the form of adult shape (asymetrical) in Andhra Pradesh.

Vidya CS et al [61] 2016, studied the anatomical variations of VA and Caecum in 28 cadavers, found that the most common shape of Caecum was adult type 75% , followed by foetal type1.2% and the least common type was infantile 10.8% in Mysore based population.

3. LENGTH OF THE CAECUM

Treves [19] 1885, reported the average length of Caecum to be about 6 cms.

According to **G.J. Romanes [43] 1987,** the length of Caecum was found to be 5 to 7 cms.

Arindom Banergee et al [4] 2012, studied the variations in VA and Caecum in 25 cadavers and found the length of the Caecum varied from 4 to 9 cms in 20 male cadavers, in 5 female cadavers it was about 5.5 to 6.5 cms.

Akilandeswari Balasubramanian et al [3] in 2103, reported a case of undescended Caecum , measuring 5cms in length in a 60 year old female cadaver.

Sivanageswara Rao et al [52] 2013, observed the average length of Caecum in adult male cadavers was 54.9mms and in female cadavers, it was about 50mms. In male foetuses the average length of Caecum was about 11.5mms and in female foetuses it was found to be 11.7mms.

Nilesh Ashok Salwe et al [36] 2014, studied in 60 cadavers and found the average length of Caecum was 7.52 cms with range from 5 cms to 10.6 cms. In males it was 8.07cms with range from 6.1cms to 10.6cms and in females it was found to be 6.97cms, ranging from 5cms to 10.2cms in Western Maharashtra region.

Garima Seghal et al [47] 2015, reported a case of malrotation of midgut in which the length of the Caecum was about 7.2 cms, in a male cadaver in Lucknow.

Sunnappu et al [58] 2015, studied adult Ileocaecal region ,in 35 male cadavers and found the average length of Caecum of 5.95 cms, ranging from 5.4 cms to 6.5 cms and in 15 female cadavers with an average length of 5.6 cms, ranging from 5 cms to 7 cms Andhra Pradesh region.

Vidya CS et al [61] 2016, found in their study the average length of the Caecum of 4.36 cms, ranging from 4.2cms to 6.8cms in 28 cadavers in Mysore based population.

4. BREADTH OF THE CAECUM

Treves [19] 1985 quoted that the average breadth of the Caecum was about 7.5 cms.

According to **G.J. Romanes [43] 1987**, the breadth of the Caecum was about 5 to 7 cms.

Arindom Banerjee et al [4] 2012, found the breadth of the Caecum ranging from 3.5 to12 cms in 20 male cadavers and 5.5 to 6.7 cms in 5 female cadavers .

Sivanageswara Rao et al [52] 2013, in his study in 40 adult cadavers, found the average breadth of the Caecum was about 6.43 cms

in 33 adult males and 5.9 cms in 7 adult females. In 50 foetuses, the average breadth was about 14.5mms.

Nilesh Ashok Salwe et al [36] 2014, in his study found the average breadth of the Caecum was about 8.48 cms, ranging from 6 cms to 12.5cms in 60 adult cadavers in Western Maharashtra region.

Sunnappu et al [58] 2015, found that the average breadth of Caecum was about 7 cms, ranging from 6.5 cms to 7.5 cms in 50 adult cadavers in Andrapradesh.

Vidya CS et al [61] 2016, stated that the average breadth of the Caecum was about 4.87 cms ranging from 3.7cms to 6.5cms in Mysore based population.

5. POSITION OF VERMIFORM APPENDIX (VA) IN RELATION TO THE ABDOMINAL QUADRANTS:

Delatour B [14] 1915, reported 3 cases of persistent embryonal types of large intestine among which one case was found to be subhepatic paracaecal VA.

Collins FK [12] 1928, reported the transposition of viscera, in which VA found to be in the left lower quadrant of abdomen.

Nagaratnam and Kotagama et al [32] 1957, reported a case of Situs inversus totalis with dextrocardia, in which the VA found to be in the LIF.

Clegg Lampty et al [11] 2006, carried out a retrospective study in 1358 VA specimens and found 99.5% of VA in the RIF and in 0.5% of the cases it was in the LIF.

Arindom Banerjee et al [4] 2012, found the majority of the VA in the RIF (96%), in 4% of the cases it was in the subhepatic region in 25 cadavers in Andhrapradhesh.

Akilandeswari Balasubramanian et al [3] in 2013, reported a case of undescended Caecum with VA in a 60 year old female cadaver, in which the VA was situated in the right lumbar region.

Chaudari Mansiha et al [10] 2013, studied the morphology of VA in 200 cases and observed that 99.5 % of VA in RIF and 0.5% in the subhepatic region in Ahmedabad.

Nagashree M V et al [33] in 2013, reported a case of undescended subhepatic Caecum and VA in a male cadaver in Karnataka.

Sivanagewara Rao et al [52] 2013, studied the position of Caecum and VA in 40 adult cadavers and observed the VA in the RIF in all cases.

Garima Seghal et al [47] 2015, reported a case of malrotation of midgut in which the Caecum and VA were lying in the subhepatic region in a male cadaver in Lucknow.

Naveena Swargam et al [34] 2015, studied the anatomical variations in the Caeco Appendicular position, observed the majority of the cases (94 %) of Caecum and VA in the RIF, 4% in the sub hepatic region and 2% in the LIF.

Sunnappu et al [58] 2015, stated that 100% of the VA was found to be in the RIF in Andhra Pradesh.

6. POSITION OF VERMIFORM APPENDIX (VA) IN RELATION TO ITS TIP :

Wakeley's [63] 1933, found the VA in the retrocaecal and retro colic in 65.28%, pelvic in 31.01%, subcaecal in 2.26%, preileal in 1% and post ileal in 0.4% and ectopic 0.05% in 10,000 cases.

Solanke TF [54] 1970, studied 203 specimens , found the VA retrocaecal in 38.4 %, pelvic in 31.2 %, post ileal in 12% , preileal in 4.8%, subcaecal 11.2%, paracaecal 2.4% in Nigeria population.

Ajmani M.L, Ajmani K [2] 1983, found the retrocaecal appendices in 58 % followed by pelvic 23%, post ileal 10%, subcaecal 5%, pre ileal 2% and paracaecal 2% in 100 cadavers.

Varshiney et al [60] 1996, found the VA was 53% of pelvic type, 19% retrocaecal, 18% paracaecal, 7% subcaecal 2% preileal and 1% post ileal in 600 specimens.

Clegg Lamptey JN et al [11] 2006, found that the most common position VA was 67.3% of retrocaecal position, followed by 21.6% in pelvic, 3.8% in post ileal, 4.4% in preileal, 2.4% in paracaecal and 0.5% in the subhepatic position in 1358 specimens.

Rahmann MM et al [41]2006, found that the most common position of VA was pelvic in 47%, followed by Retrocaecal 32%, postileal 12%, and preileal 9% in 100 cadavers.

Tahir Iqbal et al [59] 2009, found that the Retrocaecal position was highest 57%, followed by pelvic 28.6%, post ileal 9.4% and preileal 4%. The paracaecal and ectopic varieties were 5% in 500 cases including surgery for acute abdomen, postmortem and cadavers.

Geethanjali et al [20] 2011, found the most common position of VA was pelvic 36.5% followed by retrocaecal 33.5%, post ileal 12.5%, pre ileal 9.8%, subcaecal 5.8%, paracaecal 1.9% in 52 specimens.

UttamKumar Paul et al [38] 2011, reported the most common position of the VA was retrocaecal 65%, followed by pelvic 31.7% and postileal 3.3% in 60 specimens.

Shah & Shah [48] 2011,found the commonest position was retrocaecal 60%, followed by pelvic 31%, postileal 0.4%, preileal 4% , subcaecal 4.6% in 50 cadavers

Arindom Banerjee et al [4] 2012,found the Retrocaecal position of VA was highest 68% followed by promonteric 16%, pre ileal 8%, the midinguinal 4% and the subhepatic was 5% in 25 cadavers.

Ekanayake P.M.N.S et al [17] 2012, found the retrocaecal VA were 34.5% and the pelvic (7%), paracaecal (3.5%), lower pole of Caecum 31% and on the posterolateral wall 6% in 60 autopsied subjects.

Chaudhari Manisha et al [10] 2013, found the VA was retrocaecal in 55.5%, pelvic in 23.5 %, post ileal 9 %, subcaecal 6.5%, paracaecal 0.5% in total 200 cases.

Sivanageswara Rao et al [52] 2013, found the position of VA was 50% retrocaecal, 10% subcaecal, 15% pelvic, 5% promonteric, 5% mid-inguinal, 5% pre ileal, 10% post ileal in 30 adult specimens.

Nilesh Ashok Salwe et al [36] 2014, found the most common position of VA was retrocaecal 56.67% followed by pelvic type 25%, in females retrocaecal was 33.33% then the pelvic type 10% in 60 cadavers.

Sudagar M et al [56] 2014, found the commonest position of VA was retrocaecal (38%), followed by pelvic(28%), postileal(20%), subcaecal(10%) and midinguinal(4%) in 50 cadavers.

Sunnappu et al [58] 2015, found the commonest position of VA was retrocecal in 64% , in 28 % pelvic, in 4% subcaecal, in 2% pre ileal and in 2 % post ileal in 50 adult cadavers.

Shashikala Patel et al [49] 2016, found that the commonest position of VA was retrocecal 64% followed by pelvic 30%, post ileal 4% and subcaecal 2% in 50 cadavers.

Pooja Garg et al [40] 2016, observed the most common position was pelvic 51.42% followed by retrocaecal 34.28%, pre ileal 5.71%, the paracolic 5.71%, and the promonteric position was 2.85% in 35 cadavers in Rajasthan.

7. LENGTH OF APPENDIX

Ferguson[18] in 1891, found the mean length of the VA as 10.13 cms.

Berry [8] in 1895, found the mean length of the VA varies from 3.1 to 13.3 cms.

Monks and Blake [30] in 1902, found the mean length of the VA was 7.9cms, ranging from 1.0cms to 24 cms.

Deaver [13] in 1913, found the mean length of the VA varied from 1.02 to 23 cms.

Macphail [29] in 1917, observed the average length of the VA as 9.9 cms in 220 consecutive postmortem examinations.

Lewis [28] 1918, found average length of the VA was 8.3 cms, varying from 2 to 20 cms.

Arthur Robinson [5] 1923, found that average length of the VA was 9.2 cms ranging from 1.8 to 23cms.

Royster [44] 1927, found that the mean length of the VA was 7.5 cms ranging from 2.5 to 29.4cms.

Donald Collins [16] 1932, found that average length of the VA of about 8.2 cms.

Ndoye J.M et al [35] 2005, analyzed the cadaveric topography and morphometry of the VA in 80 cadavers, found that the mean length of the VA was 10.64 cms, varied between 6.5cms to 16 cms.

Ashindoitiang J et al [6] 2011, studied the incidence of appendicitis in two tribal groups in Nigeria and found that the average length of VA was 11.5 cms with the variation between 6 cm to 20 cm. The VA was on average 0.4 cm longer in males than females. It was about 11.9 cms in men and 11.5 cms in women.

Geethanjali et al [20] 2011, found the mean length of the VA was 5.9 cms, ranging from 4.2 to 10.3 cms in 52 cadavers.

Arindom Banerjee et al [4] 2012, found the length of the VA varying from 4 to 13 cms in 25 cadavers.

Chaudhari Manisha et al [10] 2012, and found that the average length of VA was 5.43 cms, ranging from 2 to 9 cms in 200 cases in Ahmedabad.

Sivanageswara Rao [52] et al 2013, found the average length of VA of 6.5 cms, ranging from 4.5cms to 10cms in 33 male adult specimens. In 7 Female adult specimens the average length of VA of 6.28 cms ranging from 5.5cms to 8cms width.

Ekanayake et al[17] 2012, found the length the VA was 8.2 cms ranging from 3cm to 10 cm out of 60 autopsied subjects.

Ahmed Ghorbani et al [1] 2014, found the average length of the VA in men was about 9.1cms and 8.0cms in women, the length varies from 8.0 to 11.9 cms in most of the cases.

NileshAshok Salwe et al [36] 2014, found the average length of VA was 5.93 cms, ranging from 2.8 cms to 12 cms in total 60 cadavers.

Philip Mwachaka et al [31] 2014, found that the mean length of the VA was 7.6cm, varies from 3.5 cms to 14.5cms. The longest VA was paracaecal type of about 11 cms, while the shortest VA was subhepatic measuring 6.3 cms.

Sunnappu et al [58] 2015, found the average length of VA of 7.82 cms, ranging from 3 cms to 13 cms in male cadavers and in female cadavers it was about 7 cms, ranging from 3 cms to 11 cms in Andra Pradesh.

8. EXTERNAL DIAMETER (EDM) OF THE VERMIFORM APPENDIX (VA):

Ferguson [18] 1891, found the mean EDM of VA was 8mms.

Deaver [13] 1913, found the mean EDM of VA was 3.5 cms.

Donald Collins [16] 1932, found the mean EDM of VA was 2 cms.

Romanes G.J [43] 1987, found that the EDM of the VA was 5mms.

Ndoye J.M et al [35] 2005, found that the mean EDM of VA was 0.6 cms, varying between 0.4 to 0.5 cms in 80 cadavers.

Arindom Banerjee et al [4] 2012, found the mean EDM of the VA was 7.8mms ± 2.8mms in 25 cadavers.

Chaudhari Mansiha et al [10] 2013, observed that mean EDM in female cadavers was 2.8 mms , ranging from 3 to 15 mms ,in male cadavers the mean EDM was 2.2 mms with the range from 4 to 14 mms in 200 cases in Ahmedabad.

Sivanagewara Rao et al [52] 2013, found the EDM of VA, varying from 5mms to 10mms with average of about 6mms in 33 male adult

specimens. In 7 Female adult specimens the EDM of VA,varying from 4mms to 7mms with average of about 5.42mms.

NileshAshok Salwe et al [36] 2014 found the average EDM of VA was about 2.8 cms ranging from 1.4 cms to 5.3 cms, in 60 cadavers.

Sunnappu et al [58] 2015, observed the average EDM of VA was 1.2 cms , ranging from 7mms to 22mms in male cadavers ,and in female cadavers it was about 1.0 cm, ranging from 5mms to 20mms in 50 cadavers in Andhrapradesh.

Pooja Garg et al [40] 2016, found that the average EDM of VA was 8 mm in male cadavers and 7.8 mms in female cadavers, ranging from 4mm to 10.5 mms in 35 cadavers in Rajasthan.

Shilpa Naik et al [51] 2017, found that the mean EDM of the VA was 0.6 cms with the range from 0.5to1.1 cms in 25 cadavers in Karnataka.

9. DISTANCE BETWEEN THE ILEOCAECAL ORIFICE (ICO) AND THE APPENDICULAR ORIFICE (APO):

Ndoye J.M et al [35] 2005, found that the distance between the ICO and the APO varies between the 15 to 40 mms with mean distance of 24.2 mms in 80 cadavers .

Ekanayake et al [17] 2012 , found that the distance between the ICO and APO varied between 1to 6 cms with a mean of 2.8 cms in 60 autopsied subjects.

NileshAshok Salwe et al [36] 2014, found the average distance between the ICO and APO was 2.47 cms, ranging from 1 cm to 4.1 cms in 60 cadavers in Maharashtra.

Sheela D Kadam et al [50] 2017 , found the average distance of ICO and APO in male was 1.8 cms with range from 1.0 cm to 3.3 cms in 19 cadavers in Maharashtra.

Shilpa Naik et al [51] 2017, found the average distance between the ICO to APO was 2.5cms, varying from 0.5 to 1.1cm in 25 cadavers in Karnataka.

10. VARIATIONS IN THE MESOAPPENDIX (MA)

Golalipour et al [21] 2003, studied the variation in the position of VA in to racial groups and found in 34.2% of the patients the MA extended upto the tip of VA, whereas in 65.8% of the patients it was incomplete. The MA failed to reach the tip in 69% of children and 64% of the adults.

Ahmed Ghorbani et al [1] 2011, found in 79.5% of cases the MA extended upto the tip of the VA. In 20.5% of the cases it was

incomplete. Incomplete MA was mostly seen in the age group below 10 years in total 200 specimens.

Ashindoitiang et al [6] 2011, studied the incidence of appendicitis in two tribal groups in Nigeria and found that in 45% of the cases the MA extended to its full length where as in 55% of the cases the MA fails to reach the tip of the VA. The MA reach the tip in 20 out of 45 (44.4%) cases in Youruba origin and only 12 out of 34(35.2%) in Ibos population.

Geethanjali et al [20] 2011, found MA extended upto the tip of the VA in 69.3% cases whereas in 30.7% of the cases it failed to reach the tip in 52 specimens.

Arindom Banergee et al [4] 2012, found that the MA was complete and extended upto the tip of VA in 4 (16%) specimens, it was short and not upto the tip in other 21(84%) specimens in 25 cadavers.

Ekanayake et al[17] 2012, found in 51.7% cases, the MA continued upto the tip and in 51.7% cases it was incomplete, in 60 autopsied subjects.

Sanjay Kumar Sinha et al [46] 2014, stated MA extended upto the tip of VA 94% cases whereas in 6% of the cases it failed to reach the tip of the VA in 50 specimens in Bihar.

Dhoot Mahesh et al [15] 2015, stated MA extended upto the tip of VA in 68.4% cases whereas in 31.6% of the cases it failed to reach the tip of the VA in 57 specimens in Bhopal.

11. VARIATIONS IN THE APPENDICULAR ARTERY (AA):

Kelly and Hurdon [26] in 1905 studied the variations in the AA and observed that the main AA supplied the distal three quarters of the appendix, while an AAA (Accessory Appendicular Artery) supplied the proximal one fourth of the VA.

Katzarski et al [25] 1979, found in 94% of the cases the VA was supplied by single AA whereas in 10% of the cases by double AA**.**

Ranganathan [42] 2002, described in his text book that the AA arises from the PCA of ICA.

Susan Standring [55] 2005, described in his text book that the AA originates from the inferior division of ileocolic branch of SMA.

Arindom Banergee et al [4] 2012, found that the VA was supplied by a single AA from the inferior division of ICA in 23 specimens and in 2 specimens along with the AA there was a recurrent AA from the PCA.

Horshmani Veeresh et al [23] 2012, conducted a study in 52 specimens and found that in 46.9% of cases, the AA arises from the inferior division of ICA, 28% from the ileal branch, 18.7% directly from

the trunk, 6.2% from arterial arcade and AAA was found in 21.8% of cases.

Sivanagewara Rao et al [52] 2013, studied the arterial pattern of VA in 40 adult cadavers and 50 foetuses and found that, all the VA specimens except one were supplied by single AA arising from ICA. In one foetal specimen, it was supplied by an AAA from the inferior division of ICA.

Sanjay Kumar Sinha et al [46] 2014, observed that the VA was supplied by a single AA branching from the inferior division of ICA in 84% of males, while in females it was 75%. AA branching directly from the ICA was observed in 14% of males and 08% of females. AAA was found in 2% of males and 17% of females in 50 cadavers in Bihar state.

Zafer Sulthana et al [64] 2014, conducted a study in 50 cadavers and found that the origin of AA was from the ileal branch of the ICA in 78%, from the PCA in 2%, from the inferior division of ICA in 16%, from the superior division of ICA in 2% and directly from trunk in 2%. They also found that the AAA in 14 % of cases and the recurrent AA in 10% of cases.

Nirmala devi et al [37] in 2015, conducted a study in 50 adult cadavers and found that in 44 cases that the VA was supplied by a single

AA, in 5 cases by double AAs and in 1 case the AA was absent since the case had undergone appendicectomy.

Ashwini Balasaheb Nuchhi et al [7] 2017, found in 15 specimens (60%) the appendix was supplied by single AA which arose mainly from the trunk of ICA, in 10 (40%) of the cases it received additional blood supply from the descending branch of ICA, common caecal and posterior caecal arteries.

Sudha K et al [57] 2017, found in 92% the appendix was supplied by single AA which arose from the trunk of ICA, in 8% of the cases it was from the inferior division of ICA, in one specimen had received additional blood supply from AAA, which arose from the descending branch of ICA.

EMBRYOLOGY

The Caecum develops from the primitive midgut. In the fifth week of embryo, the midgut is suspended from the posterior abdominal wall by a dorsal mesentery and it communicates with the yolk sac by the vitello intestinal duct.

In the adult, the midgut begins distal to the entry of bile duct in duodenum and terminates at the junction of proximal 2/3 rd and distal 1/3 rd of the transverse colon. Over its whole length the midgut is supplied by superior mesenteric artery.

By the fifth week of embryo, the presumptive ileum which can be differentiated from the presumptive colon by the presence of primordial Caecum at the junction between the two, begins to elongated rapidly. The growing ileum lengthens much more rapidly than the abdominal cavity itself, and the midgut is therefore, thrown into a dorso ventral hairpin fold, the primary intestinal loop.

The distal part of duodenum, jejunum, upper part of the ileum develops from the cephalic limb of this loop. The lower part of the Ileum, the Caecum, Vermiform Appendix, the ascending colon, proximal 2/3 rd of the transverse colon are derived from the caudal limb of primary intestinal loop. At its apex the primary intestinal loop is

attached to the umbilicus of by the vitello intestinal duct, and the superior mesenteric artery runs down the long axis of the loop.

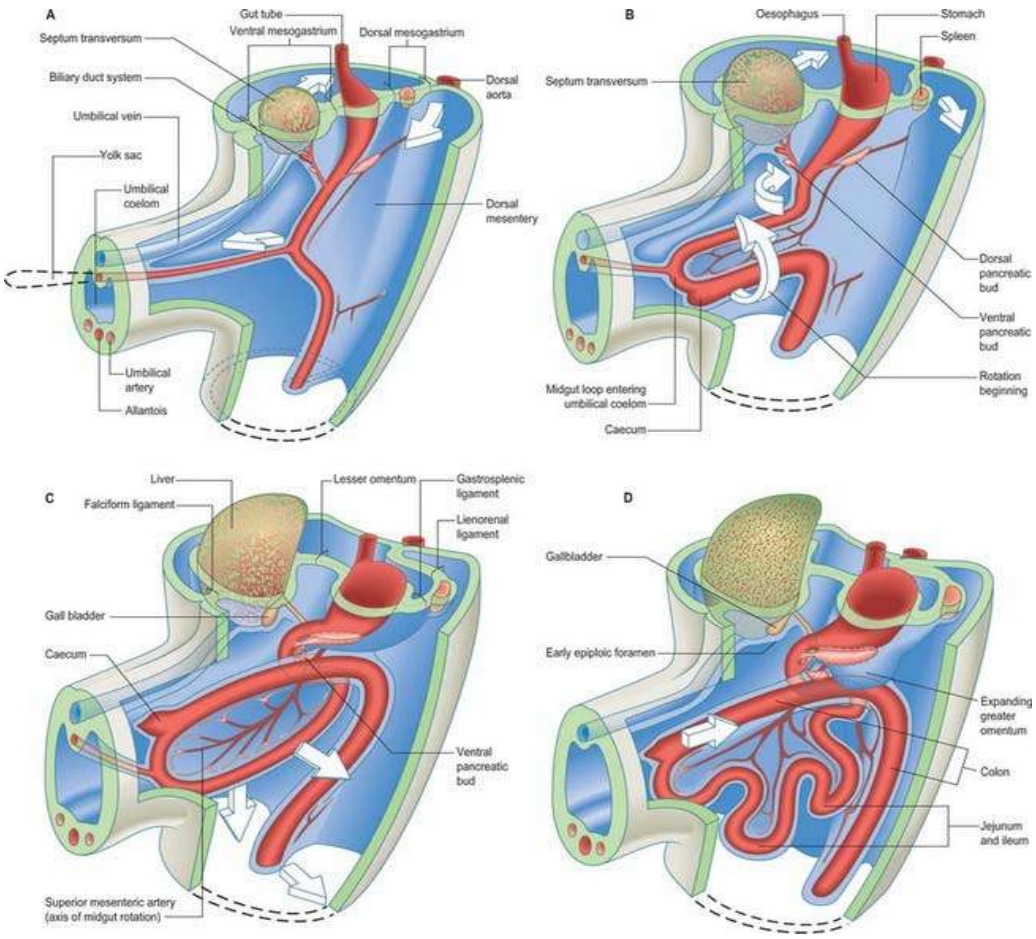
By the early 6th week of embryo, the continuing elongation of the midgut combined with the pressure resulting from the dramatic growth of the other abdominal organs (particularly the liver), forces the primary intestinal loop to be herniated into the umbilicus.

As the primary intestinal loop herniates into the umbilicus, it also rotates around the axis of superior mesenteric artery (around a dorsiventral axis) by 90 degrees counterclockwise as viewed from front. Thus the cranial limb moves caudally and to the embryo's right, and the caudal limb moves cranially and to the embryo's left.

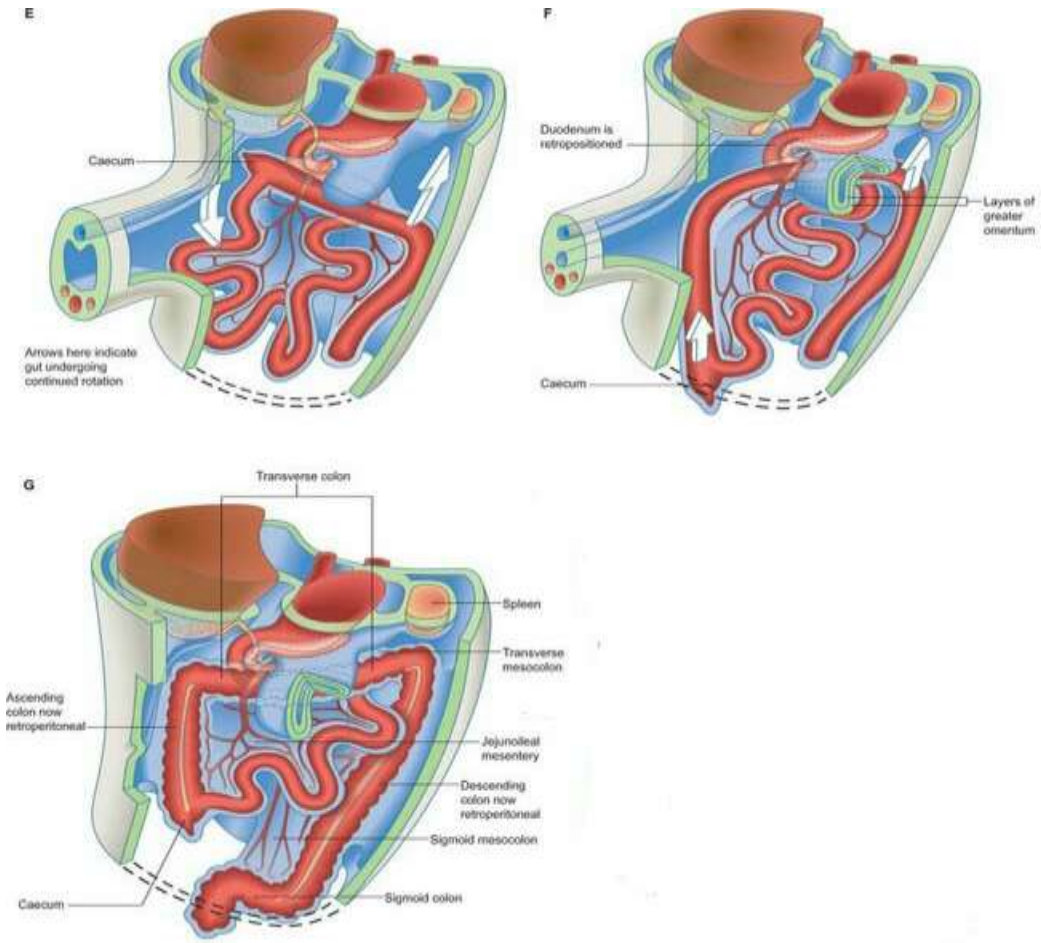
Meanwhile, the midgut continues to differentiate. The lengthening jejunum and ileum are thrown into a series of folds known as jejunal-ileal loops, and the expanding Caecum sprouts a worm like Vermiform Appendix.

During the tenth week, the midgut retracts into the abdomen. The mechanism responsible for the rapid retraction of the midgut into the abdominal cavity is not understood but may be due to the regression of the mesonephric kidney, reduced growth of the liver, and increase in the size of the abdominal cavity. As the intestinal loop renters into the abdomen, it rotates counterclockwise through an additional 180 degrees,

so that now the retracting colon has travelled a 270 degrees circuit relative to the posterior wall of the abdominal cavity. The Caecum consequently rotates just below the right lobe of the liver. Later development of the colon leads to the descent of the Caecum into the right iliac fossa. The intestines have completely returned into the abdominal cavity by eleventh week [27, 55].



Stages of development of Caecum



Stages of development of Caecum

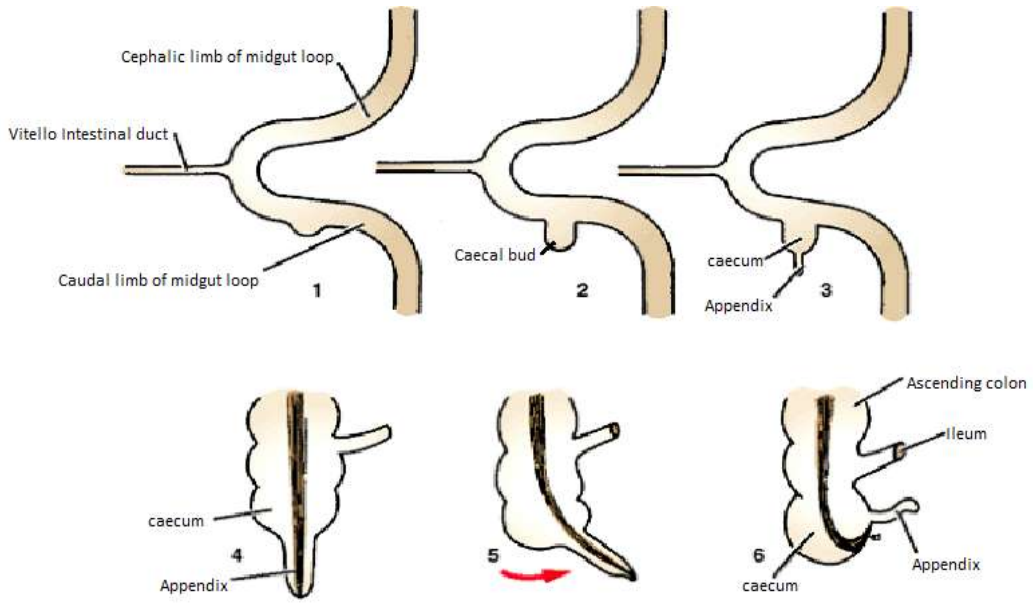
After the large intestine returns to the abdominal cavity, they are adhered to the dorsal body wall and becomes secondarily retro peritoneal by the shortening of dorsal mesenteries. The Caecum is suspended from the dorsal body wall by a shortened mesentry as soon as it returns into the abdominal cavity.

Development of Vermiform Appendix

The Vermiform Appendix develops from the distal end of the narrow part of the caecal bud which arises from the caudal limb of primary intestinal loop of primitive mid gut, to reach the the right iliac

fossa, the Caecum and appendix undergo 270 degree rotation around the axis of the superior mesenteric artery.

During the greater part of foetal life, the appendix arises from the apex of the Caecum subsequently, the lateral (or right) wall of the Caecum grows much more rapidly than the medial (or left) wall with the result that the point of attachment of the appendix comes to lie on the medial side [27,55].



Stages of development of Vermiform Appendix

ANOMALIES OF THE MIDGUT ROTATION

Non rotation of midgut

The primary intestinal loop fail to undergo normal 180 degrees counterclockwise rotation as it is retracted into the abdominal cavity. The earlier 90 degree rotation may occur normally. The result of this error, the colon and Caecum are the first parts of the gut to return from

the umbilical cord, and they settle in the left side of the abdominal cavity. The later returning loops then move more and more to the right, resulting in left sided colon.

Mixed rotations of the midgut (Malrotations)

Only the cephalic limb of the primary intestinal loop undergoes the initial 90 degree rotation, whereas only the caudal loop undergoes the later 180 degree rotation the result of this mixed or uncoordinate behavior of two limbs is that the distal end of the duodenum become fixed near the midline just inferior to the pylorus of the stomach. This abnormal position of the Caecum may cause the duodenum to be enclosed by a band of thickened peritoneum and leaves the small intestines tethered, on the right side, by a narrow mesentery that increases the risk of developing an intestinal obstruction.

Abnormalities of the mesenteries

Normally the ascending colon except for its most caudal part fuses with the dorsal abdominal wall. Ventral surface and the sides are covered by peritoneum. Persistence of a portion of the mesocolon gives rise to mobile Caecum. In the most extreme form the mesentery of the ascending colon fails to fuse with the dorsal body wall. Such a long mesentery allows the abnormal movements of the gut or even volvulus of the Caecum and colon [27, 55].

MATERIALS AND METHODS

STUDY MATERIALS

50 Adult Human Cadavers

METHOD OF STUDY

Conventional Dissection Method

SPECIMEN COLLECTION

The specimens for this study were obtained from the 50 embalmed adult human cadavers allotted for routine academic dissection to the first year MBBS and BDS students at the Institute of Anatomy, Madras Medical College, Chennai-03.

CONVENTIONAL DISSECTION METHOD

A midline vertical incision was made from the xiphoid process to the pubic symphysis. A second incision was made from xiphoid process to the midaxillary line along the costal margin. And another incision was made from the pubic symphysis to the anterior superior iliac spine on both the sides. Skin and superficial fascia were reflected laterally. The linea alba was identified, and a linear midline incision was made on the outer layer of rectus sheath from the xiphoid process to pubic symphysis. The anterior layer of the rectus sheath was reflected and the rectus abdominis muscle is identified and retracted. The posterior layer of rectus sheath is also incised.

The anterior abdominal wall muscles and the aponeurosis were cut and reflected laterally from xiphoid process to the mid axillary line along the costal margin.The rectus abdominis was cut at its origin from the pubic symphysis and pubic crest, the incision is extended laterally upto the anterior superior iliac spine by cutting the anterior abdominal wall muscles related to the inguinal ligament. The anterior abdominal wall muscles were reflected laterally to expose the greater part of peritoneal cavity.

The greater omentum was identified and turned upwards. The colon is differentiated from the small intestine by the sacculations in its wall between the three taeniae coli and appendices epiploicae. The caecum was identified as a blind sac at the commencement of ascending colon. The position of the caecum was noted down in relation to the abdominal quadrants. Transverse colon and transverse mesocolon were mobilized towards the upper abdomen to visualize the ileocaecal junction and VA. Under the guidance of anterior taenia coli, the VA was identified. A blind extension of the peritoneal cavity extends upwards in the posterior surface of the Caecum (Retrocaecal recess). In most of the cases the VA is situated in this retrocaecal recess. The position of the appendix in relation to the abdominal quadrants was noted and the position in relation to the tip of appendix was identified. The mesoappendix and its extent were noted. The appendicular artery was identified, its origin was traced and its variations were also noted.

The Caecum, Vermiform Appendix, part of ascending colon, terminal part of ileum, part of superior mesenteric artery with ileocolic artery were separated from the surrounding structures after noting the relations of ileocolic artery and its branches. Then two ligatures were applied, one on the ascending colon 10 cms from the IleoCaecal Junction (ICJ) and another ligature on the terminal ileum 5 cms from the ICJ. The Caecum and VA were removed en mass along with the arteries.

An incision was made through the lateral wall of the Caecum, and the contents were evacuated. The Caecum was washed thoroughly with running water and the interior of the caecum was examined . The ileocaecal orifice with its valves were identified. The appendicular orifice was identified. Then the specimens ere preserved in a solution containing 10% formalin and thymol [38, 43].

The following points were noted down

- The position of the Caecum and VA; whether it was in the right iliac fossa or left iliac fossa or in the lumbar or subhepatic region were noted. Photographs were taken.

- The shape of the Caecum; whether it was infantile, quadrate, adult or exaggerated type were noted. Photographs were taken of in the cadaveric caecal specimens.

- The length of the Caecum was measured from a horizontal line from the ileocaecal junction to the stretched lowest point of the

Caecum, with the help of thread and the thread's length was measured by using measuring scale and the values were recorded.

- Breadth of the Caecum was measured at the maximum convexity of the caecum with the help thread and the thread's length was measured by using measuring scale and the values were recorded.

- The position of the Vermiform Appendix in relation to its tip was noted. Based on position, the VA was categorized into retrocaecal, pelvic, pre ileal, post ileal, subcaecal groups. Photographs were taken in the cadaveric specimens.

- The length of the Vermiform Appendix from the base to the stretched tip was measured with the help of a thread and the thread's length was measured using measuring scale and the values were recorded.

- The external diameter of the VA; the transverse diameter was measured at its base with the help of vernier calipers, and the values were recorded .

- Distance between appendicular orifice and ileocaecal orifice was measured using vernier calipers and the values were recorded.

- The mesoappendix was identified and its extent from the base to the tip was traced.

- The appendicular artery and its variations were identified .

The results were tabulated and the data was analysed and compared with the previous studies.

OBSERVATION

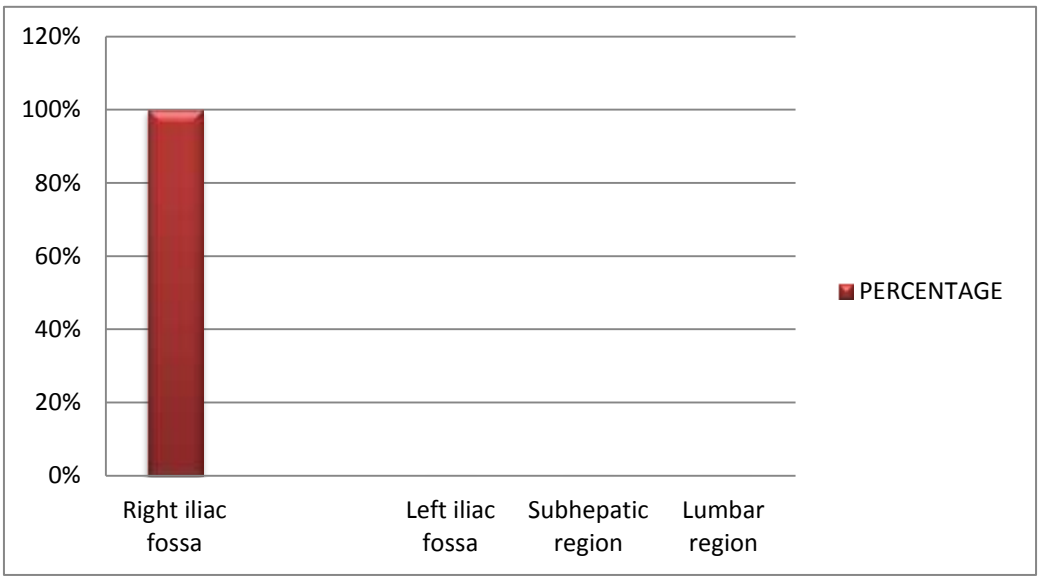
1. THE POSITION OF THE CAECUM

In the present study, the Caecum was found to be in the RIF in all the 50 cases.

Table 1: Position of the caecum

Position of caecum	Number of Specimens(50)	Percentage(%)
RIF	50	100
LIF	Nil	Nil
Subhepatic region	Nil	Nil
Lumbar region	Nil	Nil

Chart 1: Position of the caecum



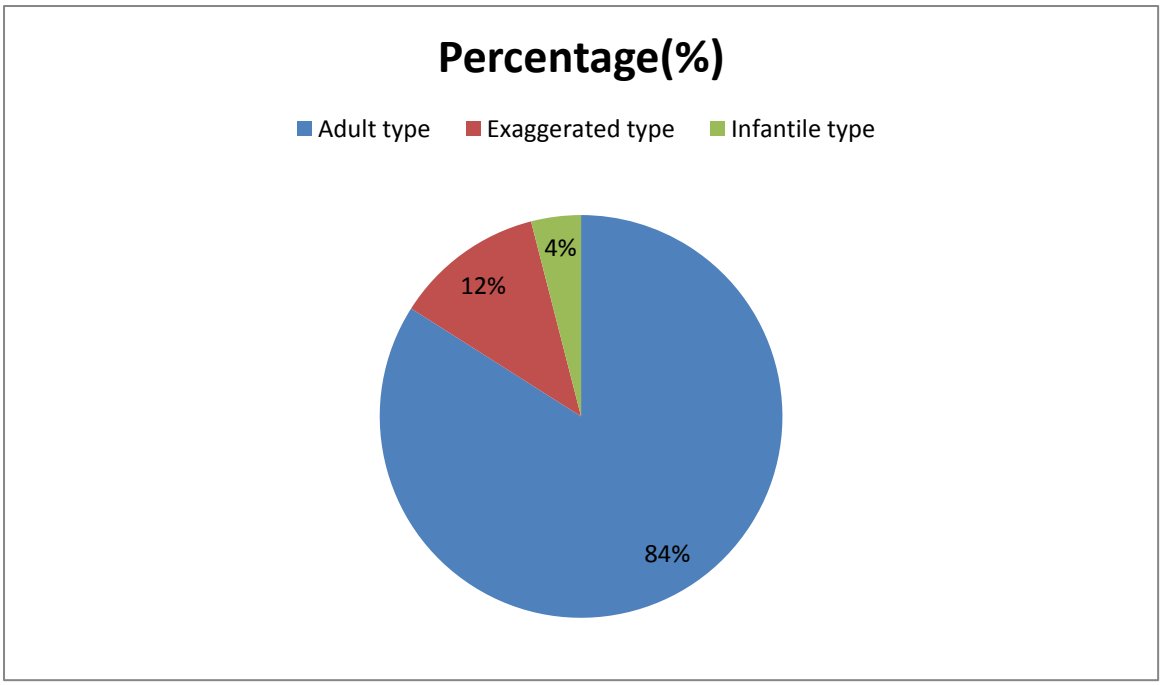
2. SHAPE OF THE CAECUM

In the present study out of 50 cases, in 42 cases it was found to be adult type, in 6 cases it was found to be exaggerated type, in only 2 cases the caecum was found to be infantile type. No evidence of foetal type was found.

Table 2: Shape of the caecum

Shape of caecum	No of specimens (50)	Percentage (%)
Adult type	42	84
Exaggerated type	6	12
Infantile type	2	4
Foetal type	Nil	Nil

Chart2: Shape of the caecum



3. LENGTH OF THE CAECUM

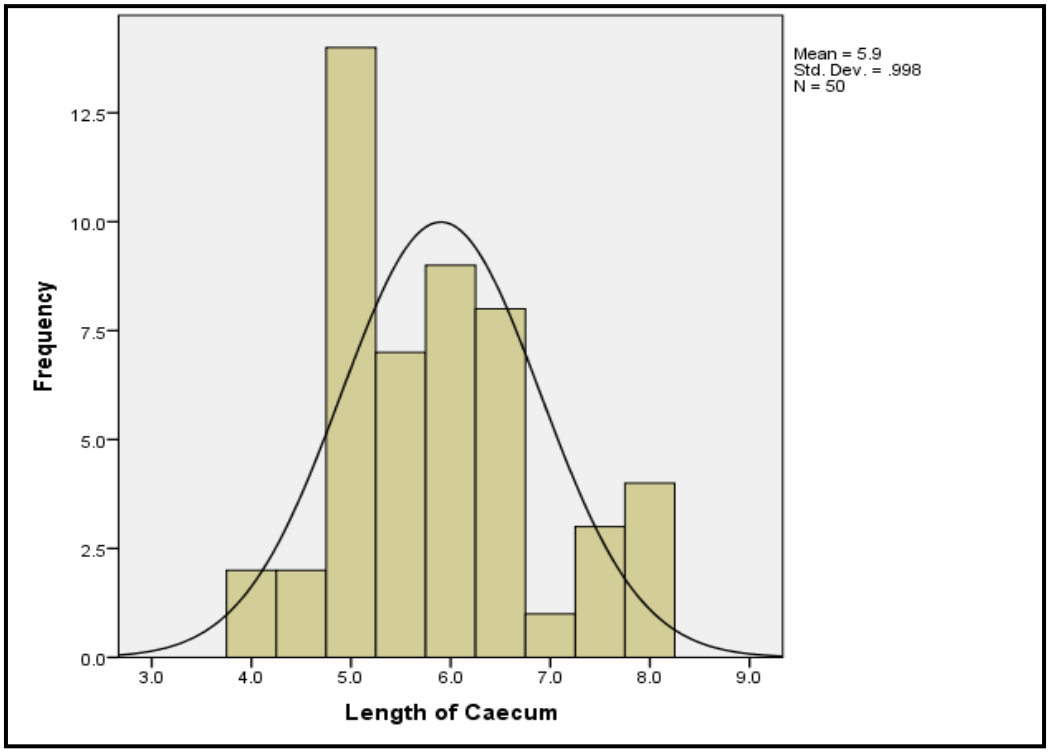
In the present study, minimum length of caecum was 4 cms, maximum length of the caecum was 8 cms, the and the mean length was 5.9± 0.99 cms.

Table 3: Length of Caecum(cms)

Number of specimens	50
Minimum	4
Maximum	8
Mean	5.9
Standard deviation	0.99

The whole range of values is shown in the histogram below

Chart 3: Length of Caecum



4. BREADTH OF THE CAECUM

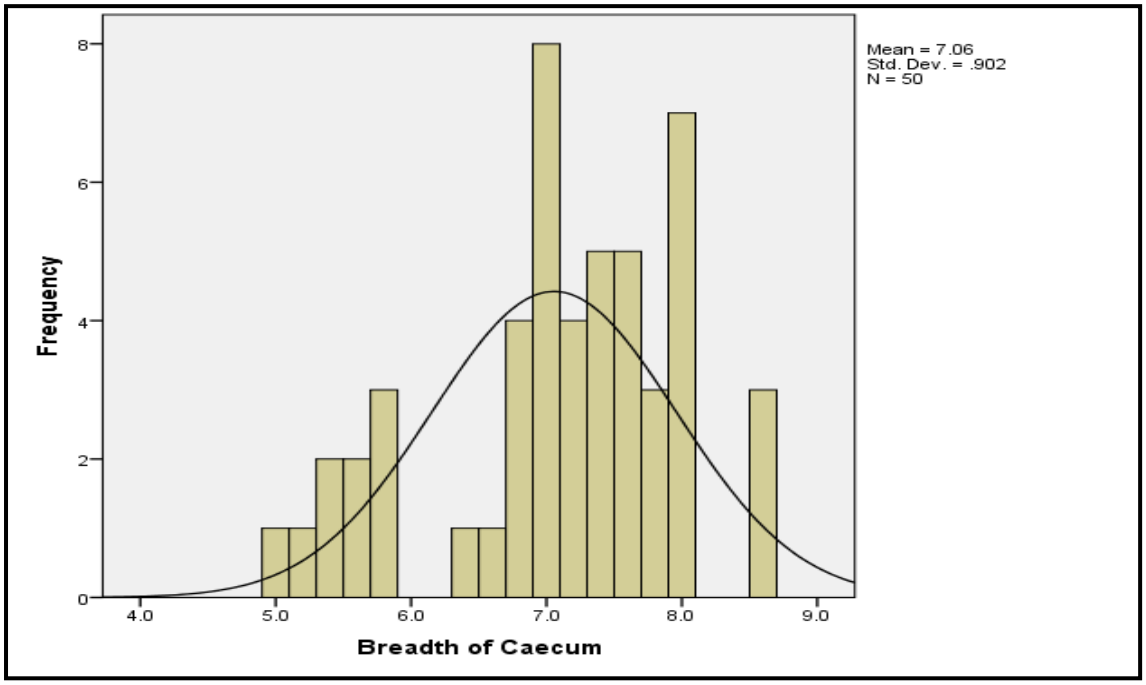
In the present study the minimum breadth of caecum was 4 cms , maximum breadth was 8.5 cms and the mean breadth of the caecum was 7.05± 0.90 cms.

Table 4: Breadth of Caecum(cms)

Number of specimens	50
Minimum	5
Maximum	8.5
Mean	7.05
Standard deviation	0.90

The whole range of values is shown in the histogram below

Chart 4: Breadth of Caecum



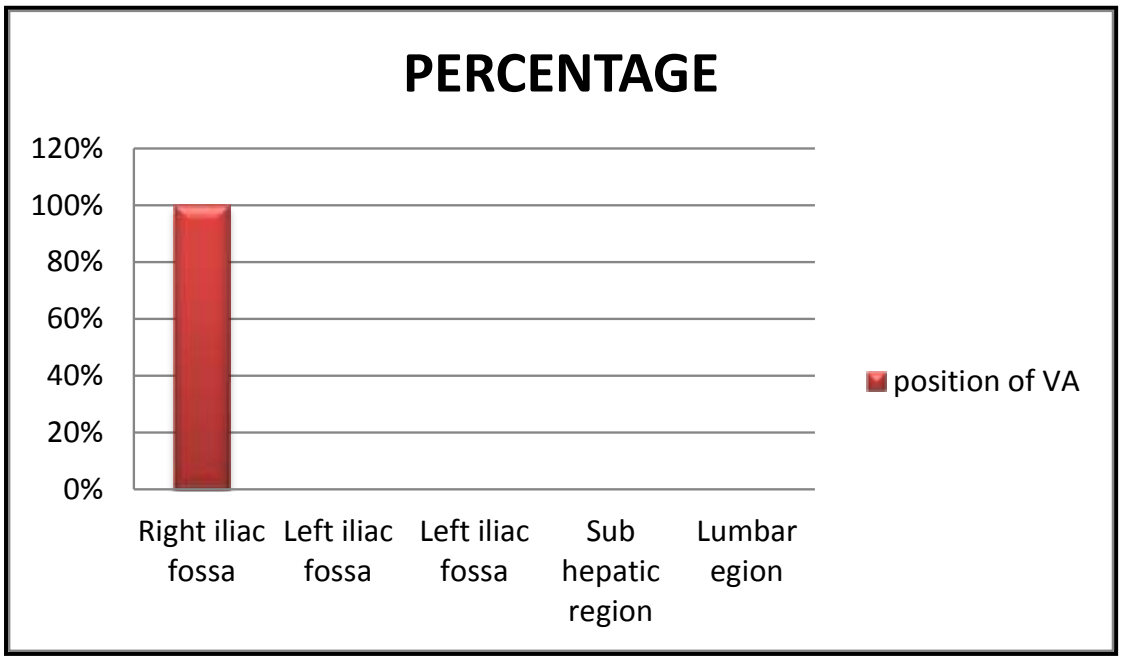
5. THE POSITION OF THE VERMIFORM APPENDIX (VA) IN RELATION TO THE ABDOMINAL QUADRANTS :

In the present study, the VA was found to be in the right iliac fossa (RIF) in all the 50 specimens.

Table 5: The Position of the VA in relation to the abdominal quadrants

Position of VA	Number of specimens (50)	Percentage (%)
RIF	50	100
LIF	Nil	Nil
Subhepatic region	Nil	Nil
Lumbar region	Nil	Nil

Chart 5: The Position of the VA in relation to the abdominal quadrants



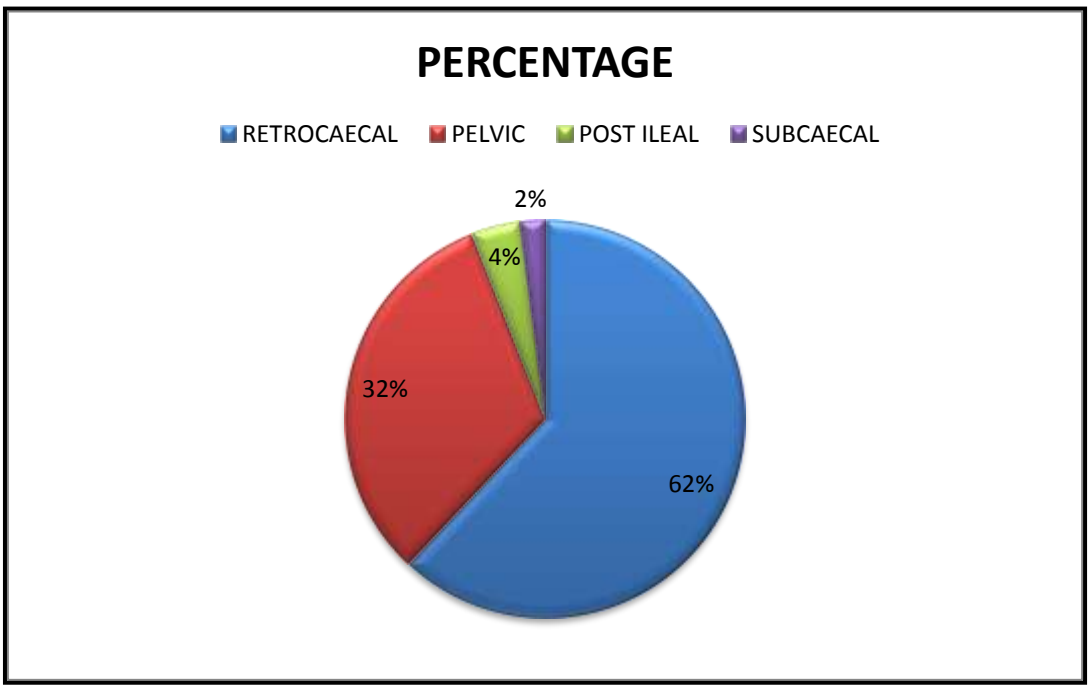
6. THE POSITION OF THE VERMIFORM APPENDIX (VA) IN RELATION TO ITS TIP

In the present study out of 50 specimens, the VA was found to be in the retrocaecal position in 31 specimens (62%). In 16 (32%) specimens it was in the pelvic position, in 2 (4%) specimens (specimen no 5 and 44) it was post ileal and in 1 specimen (2%) (specimen no 12) it was subcaecal in position . No evience of pre ileal and ectopic positions.

Table 6: Position of the VA in relation to its tip

Position of VA	Number of specimens (50)	Percentage (%)
Retrocaecal	31	62%
Pelvic	16	32%
Post ileal	2	4%
Subcaecal	1	2%

Chart 6: Position of the VA in relation to its tip



7. LENGTH OF THE VA

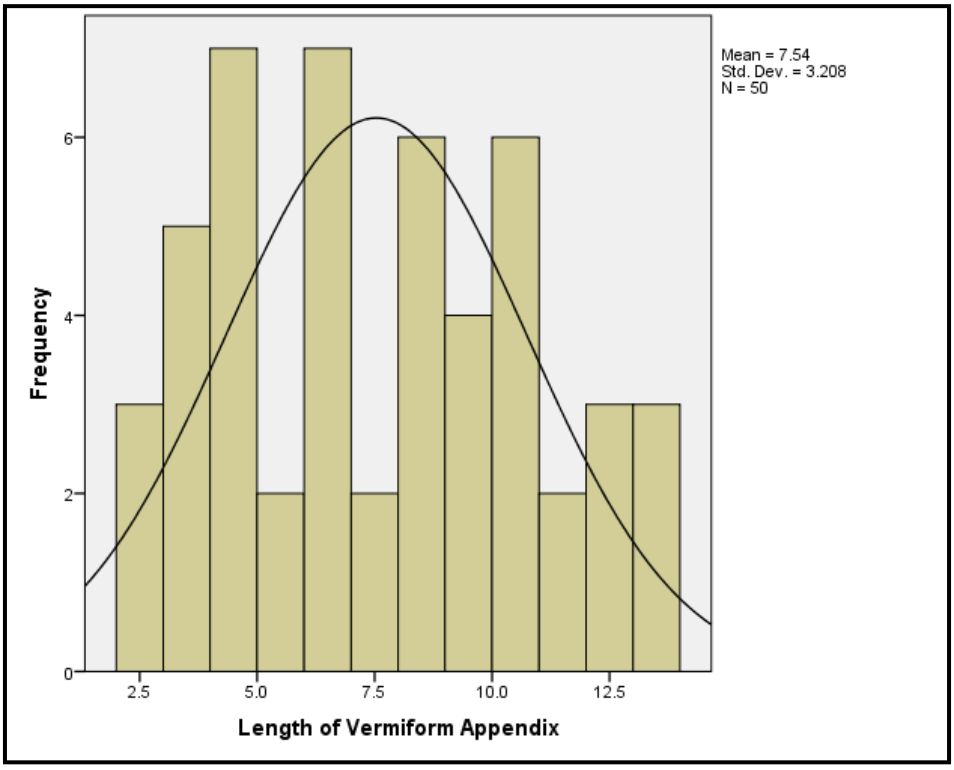
In the present study the minimum length of VA was 2.5 cms , maximum length was 13.6 cms and the average length of the VA was 7.5± 3.2 cms.

Table 7: Length of the VA(cms)

Number of specimens	50
Minimum	2.5
Maximum	13.6
Mean	7.5
Standard deviation	3.2

The whole range of values is shown in the histogram below

Chart 7: Length of the VA



8. EXTERNAL DIAMETER (EDM) OF THE VA AT THE BASE

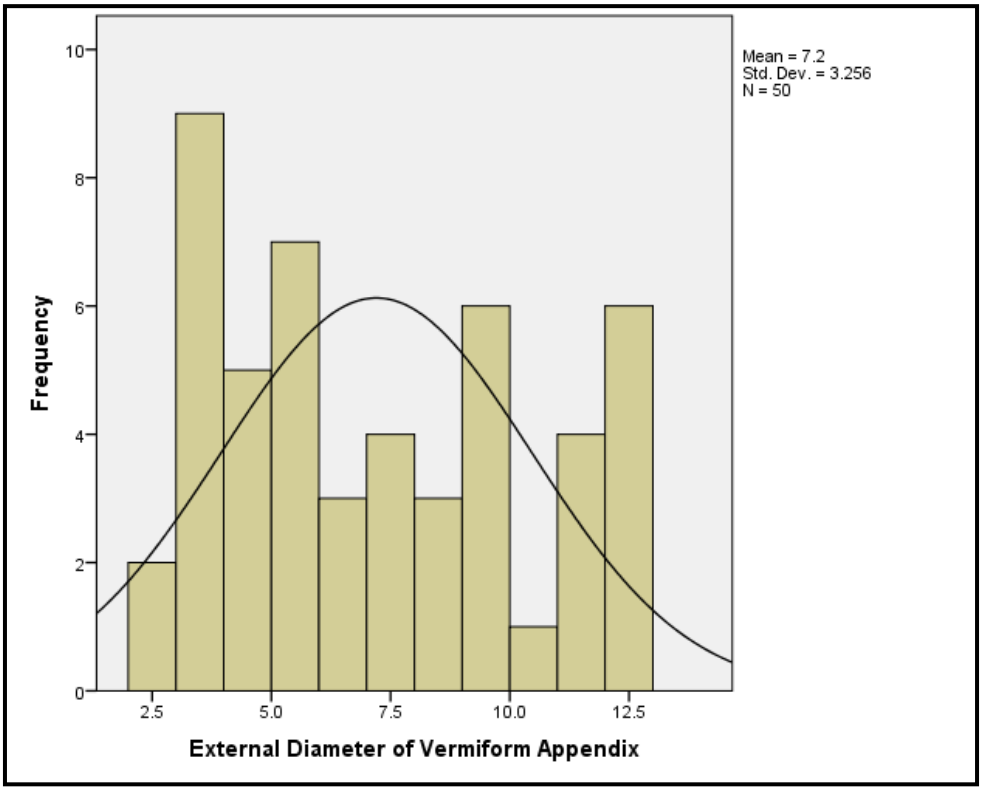
In the present study, the minimum EDM of VA was 2.8 mms , maximum EDM was 12.5 mms and the average EDM of the VA was 7.2 ± 3.25mms.

Table 8: EDM of the VA(cms)

Number of specimens	50
Minimum	2.8
Maximum	12.5
Mean	7.2
Standard deviation	3.25

The whole range of values is shown in the histogram below

Chart 8: EDM of the VA



9. DISTANCE BETWEEN THE ILEOCAECAL ORIFICE (ICO) AND APPENDICULAR ORIFICE (APO):

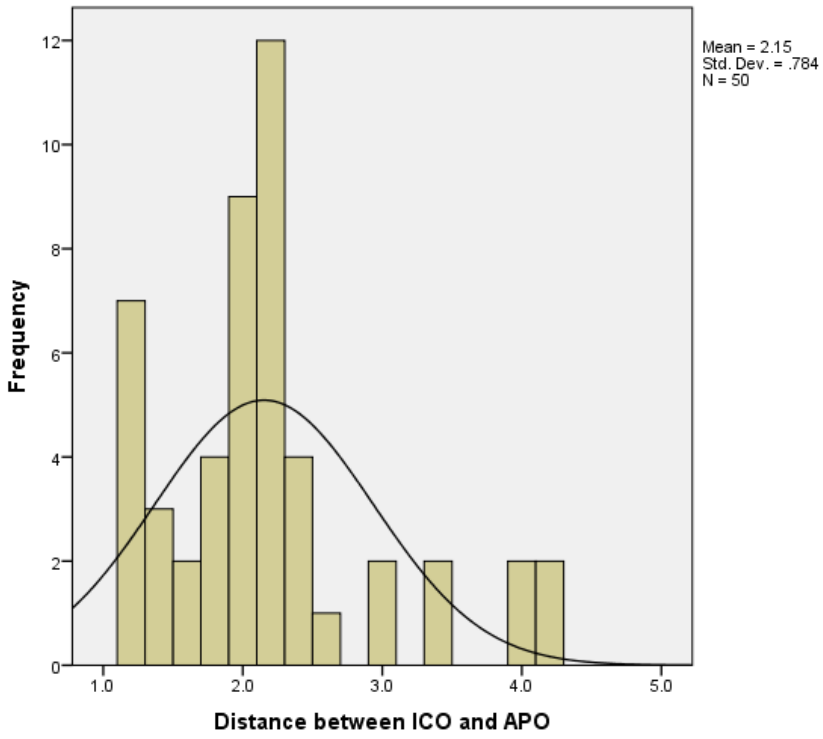
In the present study the minimum distance between APO and IPO was 1.2 cms , maximum was 4.2 cms and the average distance between APO and IPO was 2.15± 0.78 cms.

Table 9: Distance between ICO and APO(mms)

Number of specimens	50
Minimum	1.2
Maximum	4.2
Mean	2.15
Standard deviation (mms)	0.78

The whole range of values is shown in the histogram below

Chart 9: Distance ICO and APO



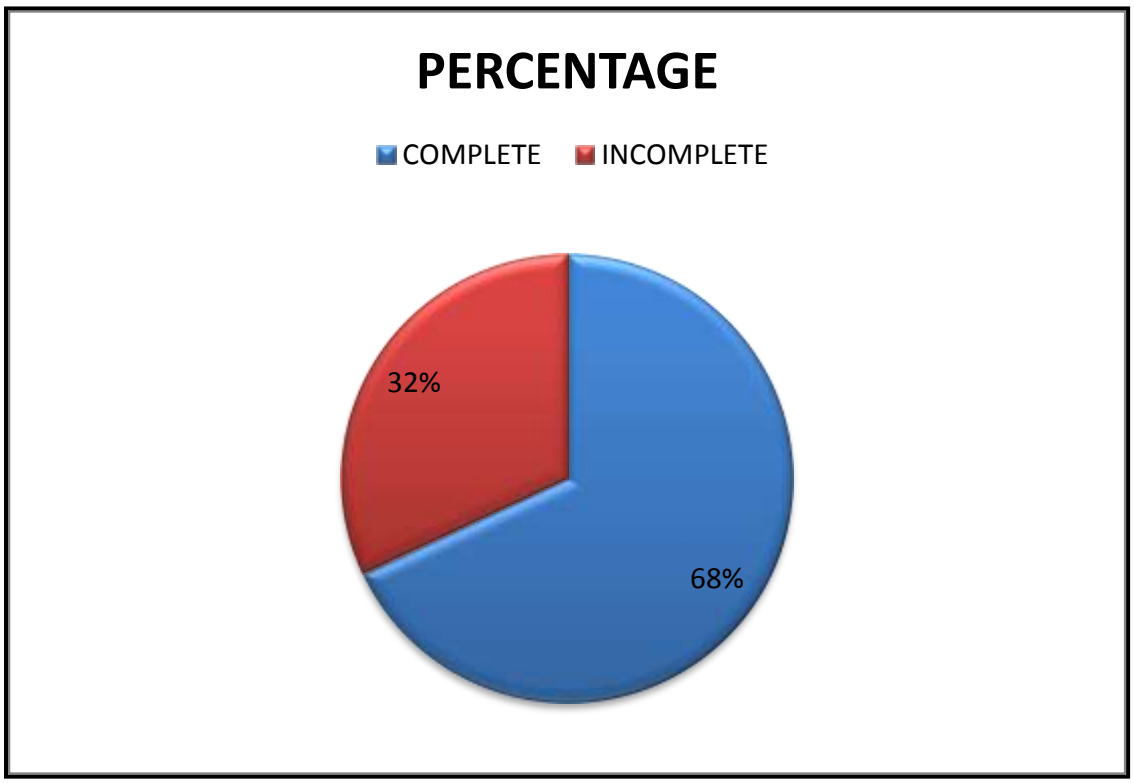
10. VARIATIONS IN THE MESOAPPENDIX (MA)

In present study out of 50 specimens the MA was complete in 34 specimens. In 16 specimens it was incomplete.

Table 10: Variations in Mesoappendix (MA)

MA	Number of specimen(50)	Percentage (%)
Complete	34	68
Incomplete	16	32

Chart 10: Variations in MesoAppendix (MA)



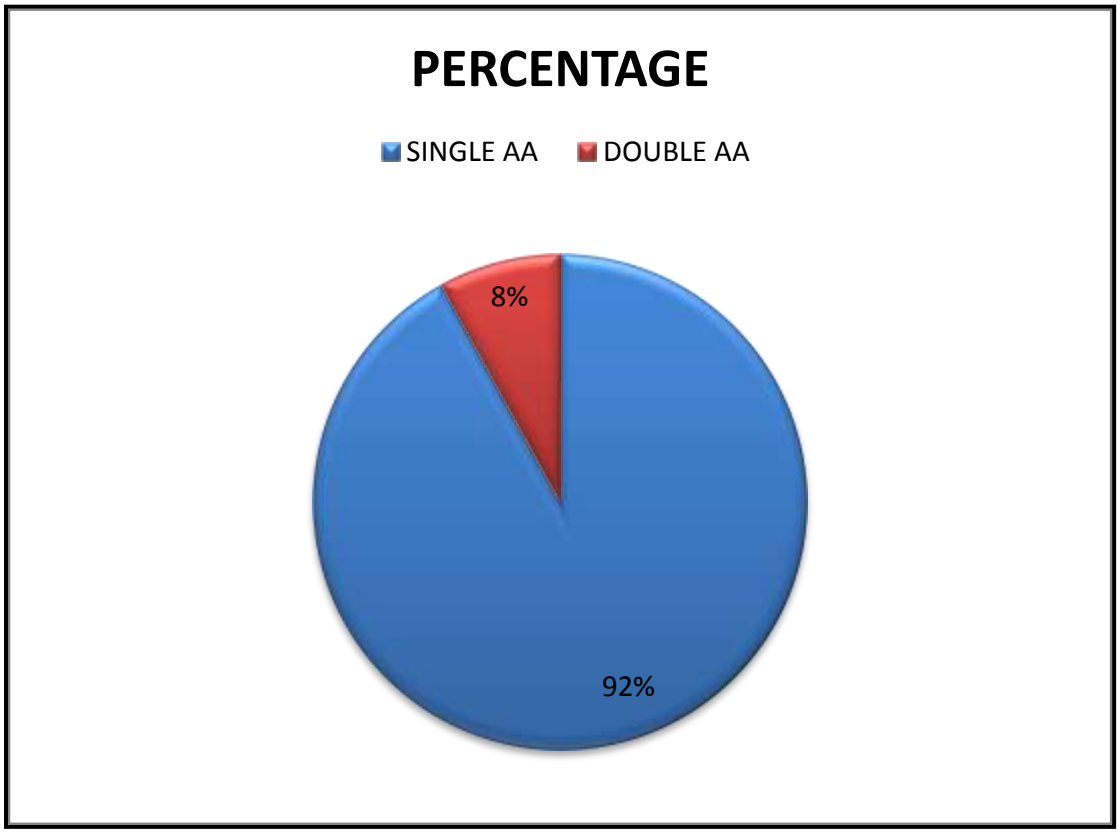
11. VARIATIONS IN THE APPENDICULAR ARTERY(AA):

In out of 50 specimens, the VA was supplied by a single AA arising from inferior division of ICA in 46 specimens, in 4 specimens it was supplied by double appendicular artery; one from the ileocolic and one from the posterior caecal artery.

Table 11: Variations in the Appendicular Artery(AA)

AA	Number of specimens(50)	Percentage (%)
Inferior division of ICA	46	92
Inferior division of ICA & PCA	4	8

Chart-11: Variations in the Appendicular Artery(AA)



DISCUSSION

1. POSITION OF THE CAECUM

According to **Arindom Banerjee et al [4] 2012**, in 96% of the cases, the Caecum was situated in the RIF, in 4 % of the cases it was in the subhepatic region.

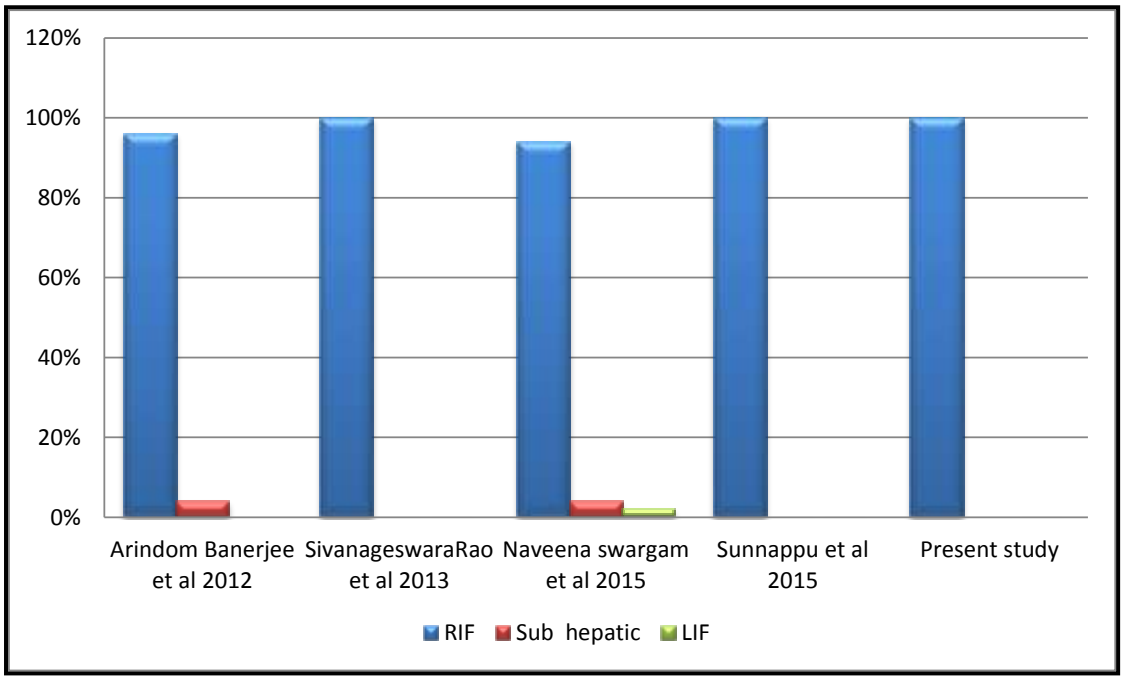
A study done by **Naveena swargam et al [34] in 2015**, was similar to the previous study, in which majority of the cases of Caecum was found to be in the RIF (94%), in 4% of the cases it was in the subhepatic region and in 2% of the cases in the LIF.

According to **SivanageswaraRao et al [52] 2013** and **Sunnappu et al 58 2015,** they found the Caecum was in the RIF in all the cases.

Table-12: Position of the Caecum

Name of the study	RIF(%)	LIF(%)	Subhepatic(%)	Lumbar(%)
Arindom Banerjee et al 2012	96	-	4	-
Sivanageswara Rao et al 2013	100	-	-	-
Naveena swargam et al 2015	94	2	4	
Sunnappu et al 2015	100	-	-	-
Present study	100	-	-	-

Chart-12: Position Of The Caecum



In the present study, the position of the Caecum was in the RIF in all the cases. It coincided with the studies of Sivanageswara Rao et al [52] and Sunnappu et al [58].

2. SHAPE OF THE CAECUM

According to **Treves [19] in 1885,** the shape of the Caecum was adult type in 90%, exaggerated type in 4%, quadrate type in 3 % and infantile type in 2 % of the cases.

A study done by **Arindom Banerjee et al [4] in 2012** in which they found the majority of the Caecum was adult shape in 88%, followed by exagerrated shape in 8% and infantile shape in 4%.

Similar study was done by **Nilesh Ashok salwe et al [36] in 2014** in which they found 73.4% of the Caecum was adult shape, exaggerated

shape was about 13.4 %, infantile shape in 8.2% and foetal shape in 5% of the cases.

According to **Sunnappu et al [58] in 2015** the Caecum was adult shape in all the cases.

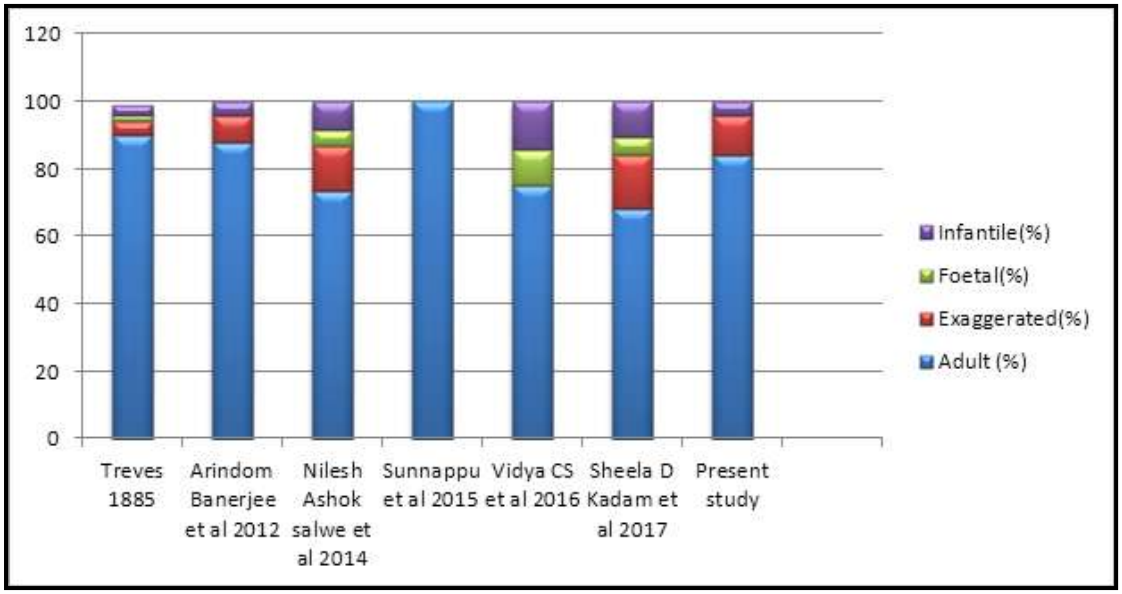
A study done by **Vidya CS et al [61] in 2016** in which they found the majority of the Caecum was in the form of adult shape in 75%, followed by infantile shape in 14.2% and the foetal shape in 10.8%.

Similar study was done by **Sheela D Kadam et al [50] in 2017** in which they found adult shape of the Caecum (68.4%), exaggerated shape (15.8%), infantile shape (10.5%) and foetal shape (5.3%).

Table-13: Shape of the Caecum

Name of the study	Adult (%)	Exaggerated(%)	Foetal(%)	Infantile(%)
Treves 1885	90	4	2	3
Arindom Banerjee et al 2012	88	8	-	4
Nilesh Ashok salwe et al 2014	73.4	13.4	5	8.2
Sunnappu et al 2015	100	-	-	-
Vidya CS et al 2016	75	-	10.8	14.2
Sheela D Kadam et al 2017	68.4	15.8	5.3	10.5
Present study	84	12	-	4

Chart 13: Shape of the Caecum



In the present study, 42(84%) specimens the Caecum was found to be adult type, in 6(12%) specimens it was found to be in exaggerated type, in 2(4%) specimens it was infantile type. This study coincided with the studies of Nilesh Ashok Salwe et al [36], Vidya CS et al [61] and Sheela D Kadam et al [50].

3. LENGTH OF THE CAECUM

According to **Arindom Banerjee et al [4] 2012**, the length of the caecum was varying from 4 to 9 cms with the mean length of 6.3 cms.

A study done by **SivanagewaraRao et al [52] in 2013**, found the mean length of caecum was about 5.4cms, ranging from 5 to 6 cms.

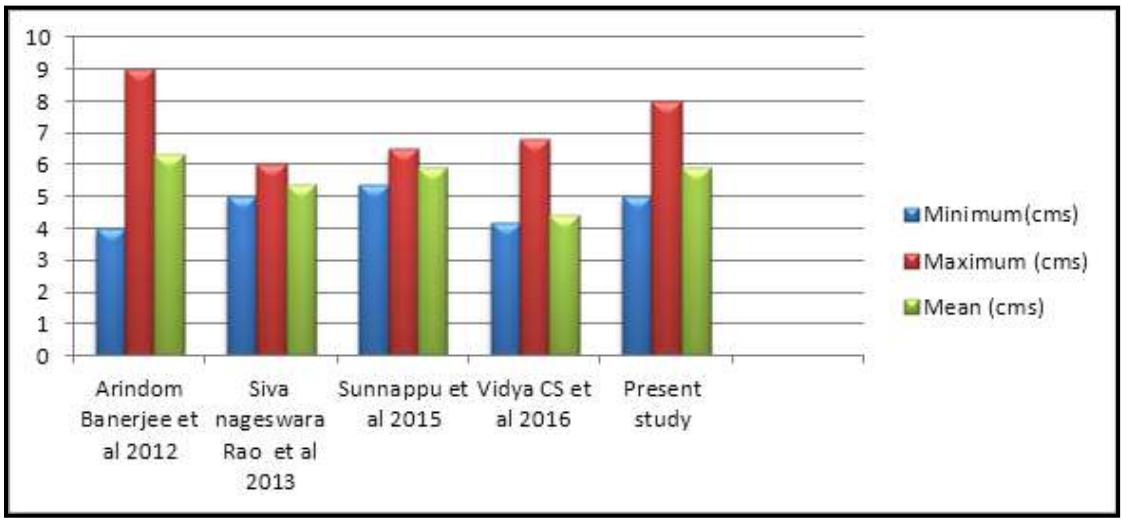
A study done by **Sunnappu et al [58] 2015** was similar to the previously mentioned study, in which it was reported that the average length of caecum was 5.6 cms, ranging from 5 cm to 7 cms.

Vidya CS et al [61] did a similar study in 2016, found that the length of the caecum ranging from 4.2cm to 6.8cms, and the mean length was 4.36 cms.

Table 14: Length of the Caecum

Name of the study	Minimum (cms)	Maximum (cms)	Mean(cms)
Arindom Banerjee et al 2012	4	9	6.3
Siva nageswara Rao et al 2013	5	6	5.4
Sunnappu et al 2015	5.4	6.5	5.9
Vidya CS et al 2016	4.2	6.8	4.4
Present study	4	8	5.9

Chart-14: Length of the Caecum



In the present study , the mean length of the Caecum was 5.9 cms, ranging from 4 to 8 cms, which coincided with the studies done by Arindom Banerjee et al [4] and Sunnappu et al [58].

4. BREADTH OF THE CAECUM

A study done by **Arindom Banerjee et al [4] in 2012** , found the breadth of the Caecum varying from 3.5 to12 cms with mean breadth of 6.8cms.

According to **Sivanagewara Rao et al [52] in 2013** the mean breadth of Caecum was about 5.9 cms ranging from 5 to 7 cms.

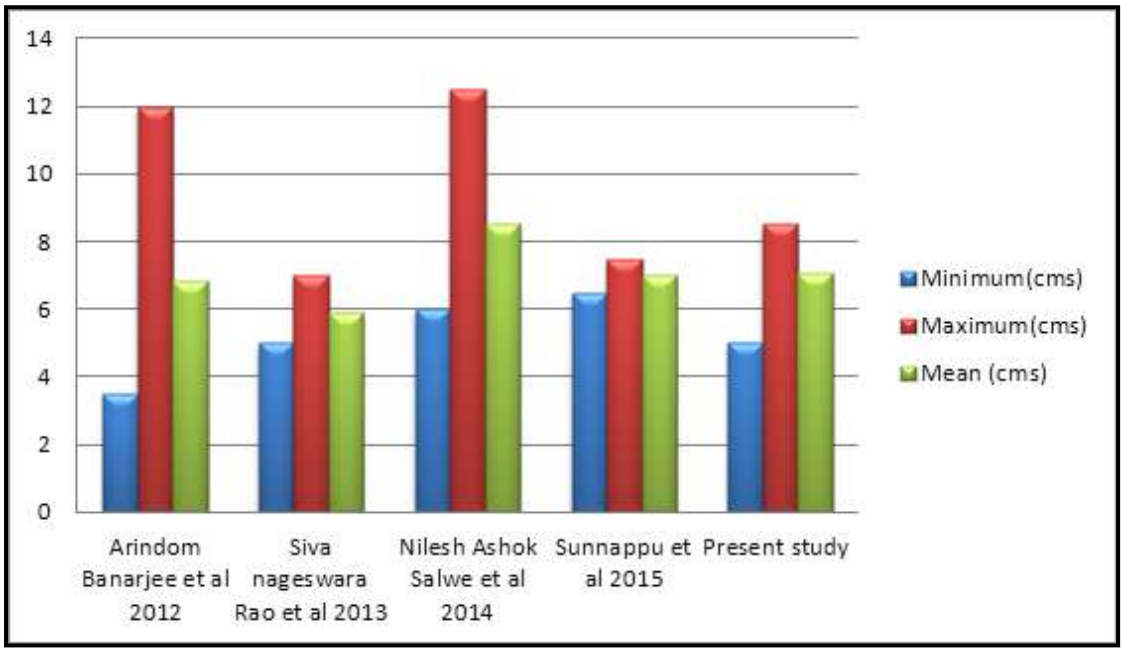
A similar study was done by **Nilesh Ashok Salwe et al [36] in 2014,** found the average breadth of the Caecum was 8.48 cms , ranging from 6 cm to 12.5cms.

A study done by **Sunnappu et al [58] 2015,** found the breadth of Caecum was ranging from 6.5 cms to 7.5 cms with the mean length of 7 cms.

Table 15: Breadth of the Caecum

Name of the study	Minimum(cms)	Maximum(cms)	Mean (cms)
Arindom Banarjee et al 2012	3.5	12	6.8
Siva nageswara Rao et al 2013	5	7	5.9
Nilesh Ashok Salwe et al 2014	6	12.5	8.5
Sunnappu et al 2015	6.5	7.5	7
Present study	5	8.5	7.05

Chart 15: Breadth of the Caecum



In the present study, the average breadth of the Caecum was 7.05 cm, ranging from 5 to 8.5 cm which coincided with the studies done by Arindom Banerjee et al 4 and Sunnappu et al 58.

5. POSITION OF APPENDIX IN RELATION TO ABDOMINAL QUADRANT:

A study was done by **Nyode JM et al [35] in 2005,** they found 97.5% of VA in RIF, 2 % in LIF and 0.5% in subhepatic region.

According to **Clegg Lampty et al [11] 2006**, 99.5% of VA was in the RIF, 0.5 % in the LIF.

A similar study was done by **Arindom Banerjee et al [4] in 2012**, where they found the VA in the RIF in 96% and in 4% it was in the subhepatic region.

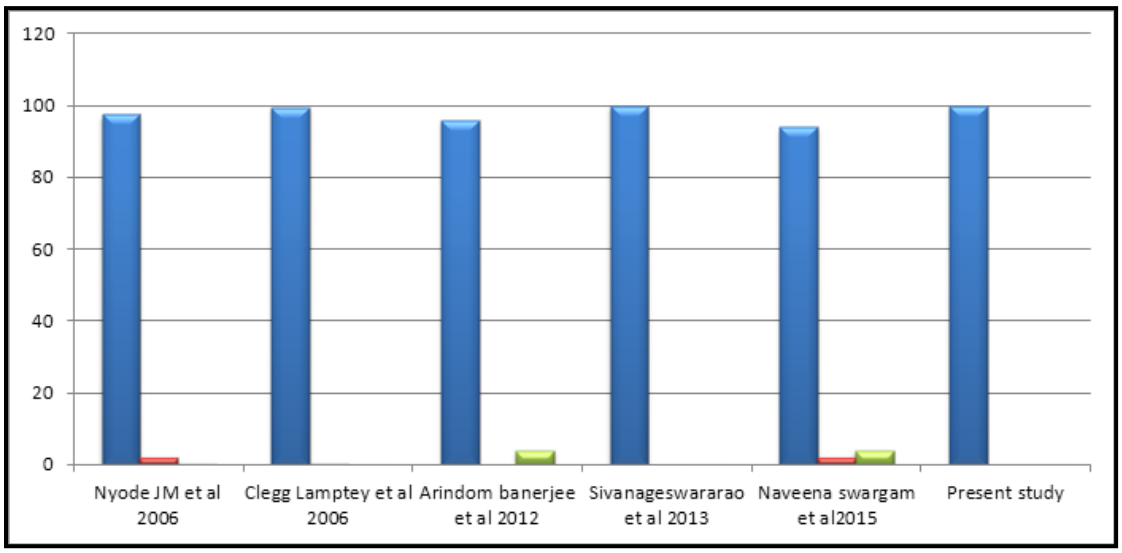
According to **Sivanagewara Rao et al [52] in 2013,** found the VA in the RIF in 100% of the cases.

A similar study was done by **Naveena Swargam et al [34] in 2015,** found the VA in the RIF in 94%, in 4% it was subhepatic in position and in 2% it was in the LIF.

Table 16: Position of VA in Relation to Abdominal Quadrant

Name of the study	RIF(%)	LIF(%)	Subhepatic(%)	Lumbar(%)
Nyode JM et al 2006	97.5	2	0.5	-
Clegg Lamptey et al 2006	99.5	0.5	-	-
Arinom banerjee et al 2012	96	-	4	-
Sivanageswararao etal 2013	100	-	-	-
Naveena swargam etal 2015	94	2	4	-
Present study	100	-	-	-

Chart 16: Position of Va In Relation to Abdominal Quadrant



In the present study , the position of the VA was in the RIF in all the cases, which coincided with the studies of Sivanageswara Rao et al [52] and Clegg Lamptey JNA et al[11].

6. POSITION OF THE VERMIFORM APPENDIX (VA) IN RELATION TO ITS TIP:

Clegg Lamptey JN et al [11] 2006 in their retrospective study found in 67.3% of cases the VA was in the retrocaecal position, followed by 21.4% in the pelvic, 4.4% in the pre ileal, 3.8% in the post ileal, 2.4%in the paracaecal and 0.5% in the subhepatic position.

According to **Shah & Shah [48] in 2011**, the commonest position of VA was retrocaecal 60%, followed by pelvic 31%, post ileal 0.4%, pre ileal 4% and subcaecal 4.6% .

A similar study was done by **Arindom Banerjee et al [4]2012**, in which the Retrocaecal position of VA was highest (68%), followed by promonteric (16%), pre ileal (8%), midinguinal 4% and ectopic subhepatic type was found in 5%.

According to **Chaudhari Manisha et al [10] 2013**, the VA was retrocaecal in 55.5%, pelvic in 23.5 %, post ileal in 9 %, subcaecal in 6.5% and paracaecal in 0.5%.

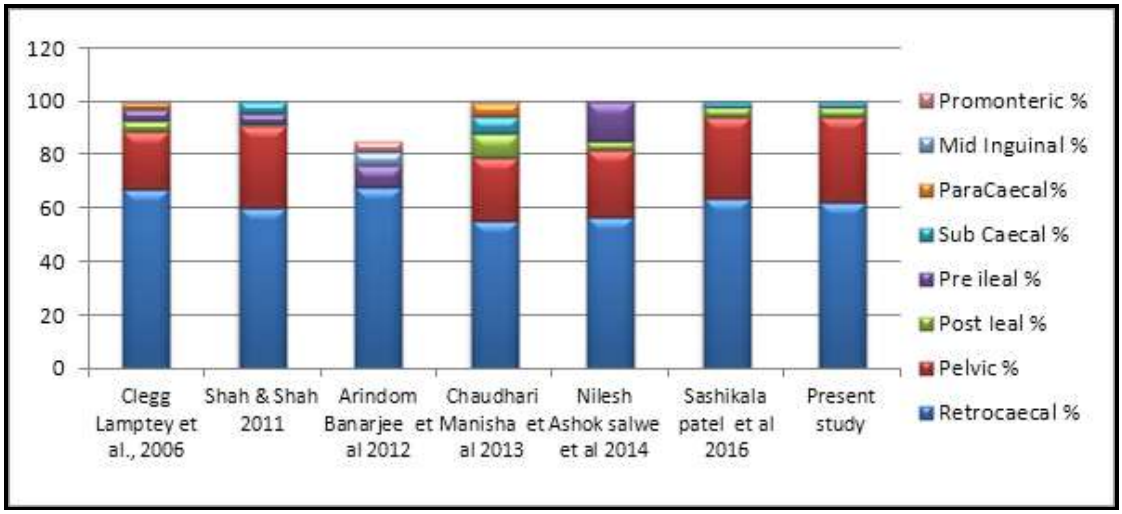
A study was done by **Nilesh Ashok Salwe et al [36] in 2014**, in which the most common position of VA was retrocaecal 56.6% followed by pelvic type 25%, preileal 15% and post ileal type 3.5%.

A similar study done by **Shashikala Patel et al [49] 2016,** found the commonest position of the VA was retrocecal 64%, followed by pelvic 30%, post ileal 4% and subcaecal 2%.

Table 17: Position of the Vermiform Appendix (VA) In Relation to its Tip

Name of the study	Retro caecal (%)	Pelvic (%)	Post ileal (%)	Pre ileal (%)	Sub ceacal (%)	Para caecal (%)	Sub hepatic (%)	Mid Inguinal (%)	Promon teric (%)
Clegg Lamptey et al 2006	67.3	21.6	3.8	4.4	-	2.4	0.5	-	-
Shah & Shah 2011	60	31	0.4	04	4.6	-	-	-	-
Arindom Banarjee et al 2012	68	-	-	08	-		05	04	16
Chaudhari Manisha et al 2013	55.5	23.5	09	-	6.5	05	0.5	-	-
Nilesh Ashok salwe et al 2014	56.6	25	3.4	15	-	-	-	-	-
Sashikala patel et al 2016	64	30	04	-	02	-	-	-	-
Present study	62	32	04	-	02	-	-	-	-

Chart 17: Position Of The Vermiform Appendix (VA) In Relation To Its Tip



In the present study, the VA was found to be in the retrocaecal position in 31 specimens (62%). In 16 (32%) specimens it was in the pelvic position, in 2 (4%) specimens it was post ileal and in 1 specimen (2%) it was subcaecal in position. This study coincided with the studies of Arindom Banerjee et al [4], Clegg Lamptey et al [11], Sahikala patel et al [49].

7. LENGTH OF APPENDIX

A study done by **Geethanjali et al [20] 2011,** in which they found the mean length of the VA was about 5.9 cms and the length varying between 4.2 to 10.3cms.

A similar study was done by **Arindom Banerjee et al [4] in 2012**, found the length of the VA varying from 4 to 13 cms with the average length of VA measuring 6.3cms.

According to **Philip Mwachaka et al [31] 2014** the average length of VA was about 7.5 cms.

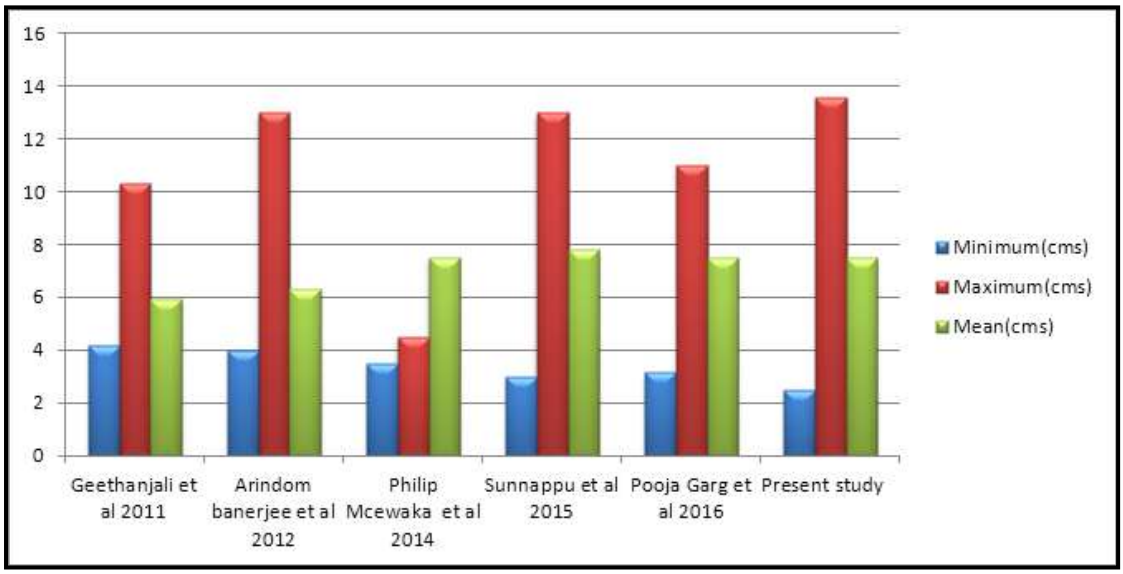
According to **Sunnappu et al [58] in 2015** the mean length of VA was about 7.8 cms.

According to **Pooja Garg et al [40] 2016** the average length of VA was about 7.5 cms.

Table 18: Length of the VA

Name of the study	Minimum(cms)	Maximum(cms)	Mean(cms)
Geethanjali et al 2011	4.2	10.3	5.9
Arindom banerjee et al 2012	4.0	13.0	6.3
Philip Mcewaka et al 2014	3.5	4.5	7.5
Sunnappu et al 2015	3.0	13.0	7.8
Pooja Garg et al 2016	3.1	11.0	7.5
Present study	2.5	13.6	7.5

Chart 18: Length of the VA



In the present study, the average length of the VA was 7.5 cms and it varied between 2.5 cms to 13.6cms which coincided with the studies of Philip Mcewaka et al [31], Sunnappu et al[58] and Pooja Garg et al [40].

8. EXTERNAL DIAMETER OF THE VERMIFORM APPENDIX

According to **Nyode J.M et al [35] in 2005** the mean EDM of VA was about 6.8 mms varying between 4 to 15 mms.

A study done by **Arindom Banerjee et al [4] in 2012**, the EDM of the VA was about 7.8mms.average

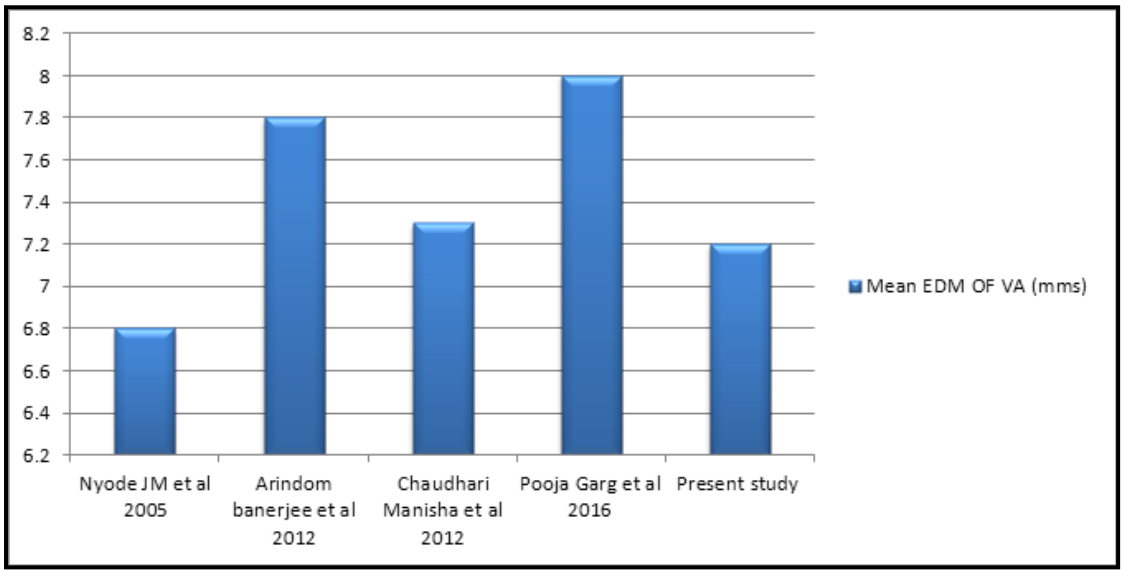
A similar study was done by **Chaudhari Mansiha [10] 2013,** found that mean EDM was 6.5 mms, ranging from 4 to 14 mms.

According to **Shilpa Naik et al [51] 2017**, the average EDM of VA was 6 mms, varying from 5 to 11mms.

Table 19: Mean EDM of the VA

Name of the study	Mean EDM OF VA (mms)
Nyode JM et al 2005	6.8
Arindom banerjee et al 2012	7.8
Chaudhari Manisha et al 2012	6.5
Shilpa Naik et al 2017	6.0
Present Study	7.0

Chart 19: Mean EDM of the VA



In the present study, the average EDM of the VA is 7.2mms, ranging from 2.5 mms to 12.5mms which coincided with the study done by Nyode JM et al [35].

9. DISTANCE BETWEEN THE ILEOCAECAL ORIFICE(ICO) AND APPENDICULAR ORIFICE(APO):

According to **Ndoye J.M.N et al [35] 2005,** the distance between the ICO and APO was varying from 1.5 cms to 4 cms with the mean distance of 2.42 cms.

A study was done by **Ekanayake et al [17] in 2012,** in which they found the distance between the ICO and APO was varying from 1 to 6 cms with a mean of 2.8 cms.

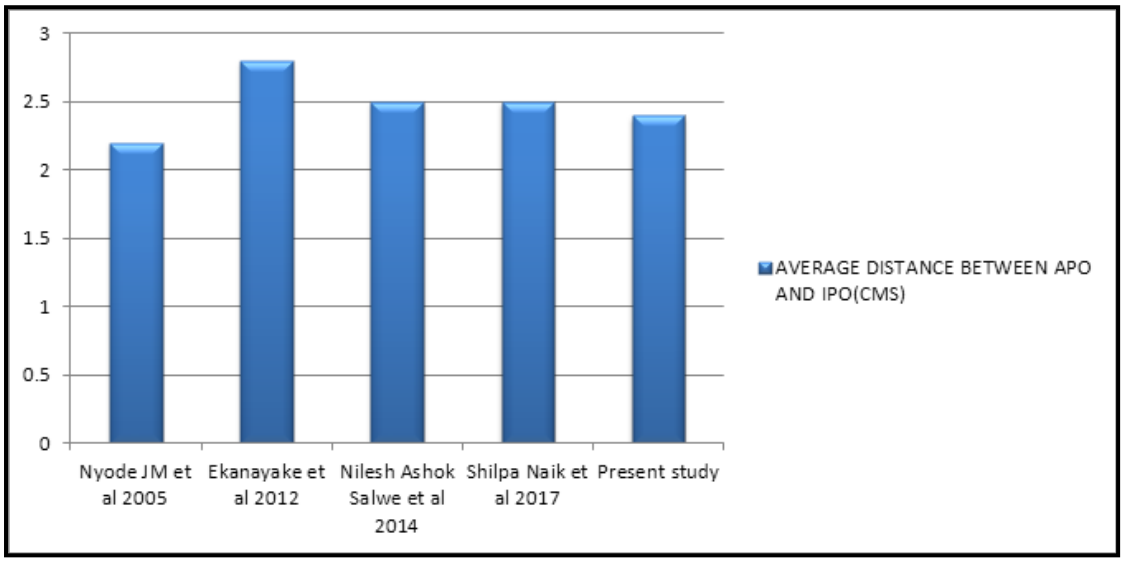
A similar study was done by **Nilesh Ashok Salwe et al [36] in 2014** found the average distance between the ICO to APO was 2.5cms varying from 1 to 4 cms.

According to **Shilpa Naik et al [51] 2017** found the average distance between the ICO to APO was 2.5cms varying from 1.5 to 3cms.

Table 20: Distance Between ICO and APO

Name of the study	Average distance between ICO and APO(cms)
Ndoye JM et al 2005	2.2
Ekanayake et al 2012	2.8
Nilesh Ashok Salwe et al 2014	2.5
Shilpa Naik et al 2017	2.5
Present study	2.4

Chart 20: Distance Between ICO and APO



In the present study , the average distance between ICO and the APO is found to be 2.36cms varying from 1.2 to 4.2 cms which coincided with the studies of Ndoye J.M et al [35], Nilesh Ashok Salwe et al[36] and Shilpa et al [51].

10. VARIATIONS IN THE MESOAPPENDIX (MA)

According to **Ahmed Ghorbani et al [1] 2011**, in 79.5% of cases the MA extended upto tip of the VA, in 20.5% of the cases it was incomplete.

A study done by **Geethanjali et al [20] 2011,** in which the extension of MA was complete, in 69.3% cases whereas in 30.7% it was incomplete.

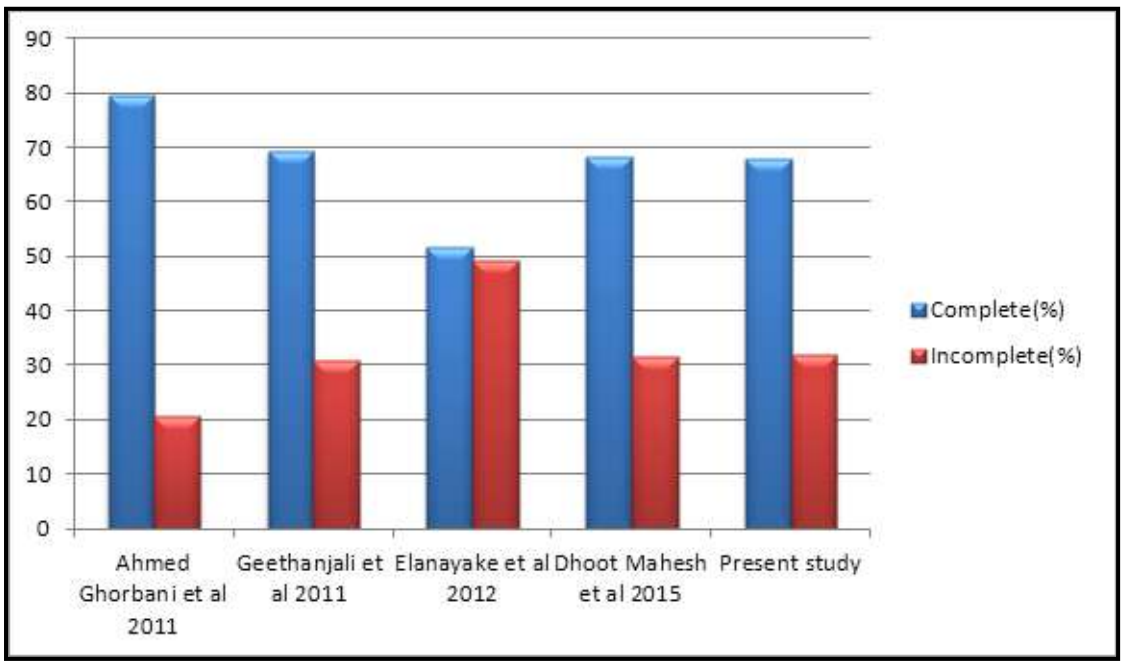
A similar study done by **Ekanayake et al[17] 2012,** in which they found in 51.7% subjects the MA was complete , in 49.3% subjects it was incomplete.

According to **Dhoot Mahesh et al [15] 2015,** in 68.4% cases the MA was complete, whereas in 31.6% of the cases it was incomplete.

Table 21: Variations in the MesoAppendix (MA)

Name of the study	Complete (%)	Incomplete (%)
Ahmed Ghorbani et al 2011	79.5	20.5
Geethanjali et al 2011	69.2	30.8
Elanayake et al 2012	51.7	49.3
Dhoot Mahesh et al 2015	68.4	31.6
Present study	68.0	32.0

Chart 21: Variations in the MesoAppendix (MA)



In present study, the MesoAppendix was complete in 34 (68%) specimens whereas in 16 (32%) specimens in was incomplete . This study coincided with the studies done by Geethanjali et al [20] an Dhoot Mahesh et al [15].

11. VARIATIONS IN THE APPENDICULAR ARTERY (AA):

According to **Katzarski et al [25] 1979** in 94% of the cases the VA was supplied by single AA whereas in 6% of the cases by double AA.

A study was done by **Arindom Banerjee et al [4] 2012**, in which VA was supplied by single appendicular artery from the inferior division of ileocolic artery in 92% of the specimens whereas in 8% of the specimens it was supplied by double AA.

According to **Sanjay kumar sinha et al [46] 2014,** in 94% of the cases the VA was supplied by single AA whereas in 6% of the cases by double AA**.**

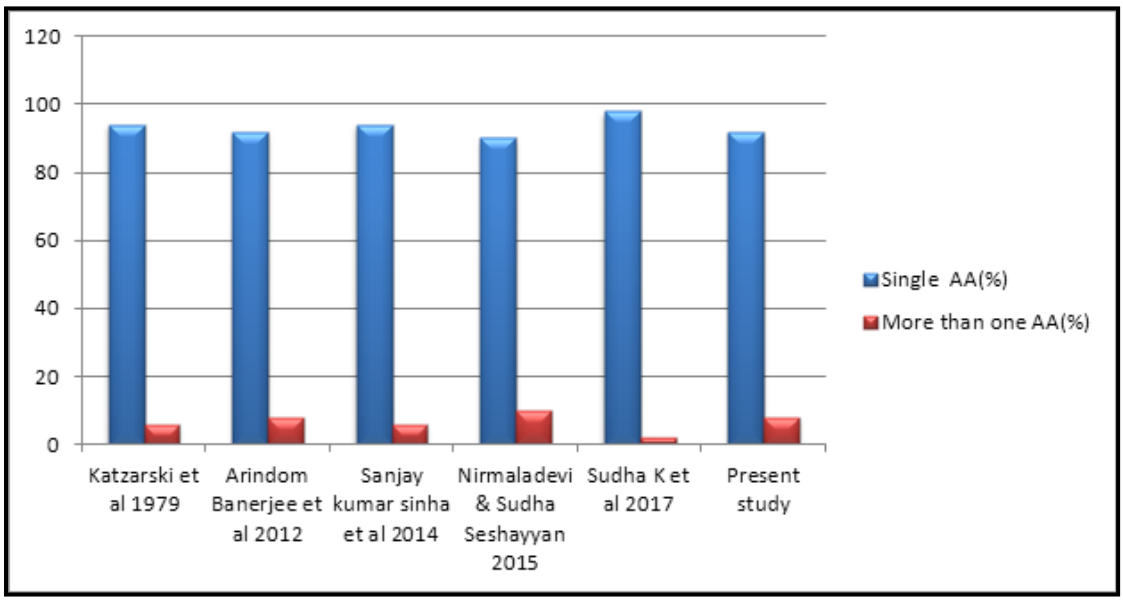
A similar study was done by **Nirmala Devi, Sudha Seshayyan et al [37] 2015,** in which in 90% of the specimens single AA was arising from the inferior division of the ileocolic artery (42 specimens) and from the posterior caecal artery (2specimens). In 10% of the cases the VA was supplied by double AA(5 specimens).

According to **Sudha K et al [57] 2017,** in 46 cases (92%) the VA was supplied by single AA arose from the trunk of ICA, in 4 (8%) of the cases it was supplied by double AA.

Table 22: Variations in the Appendicular Artery (AA)

Name of the study	Single AA (%)	More than one AA (%)
Katzarski et al 1979	94	6
Arindom Banerjee et al 2012	92	8
Sanjay kumar sinha et al 2014	94	6
Nirmaladevi & Sudha Seshayyan et al 2015	90	10
Sudha K et al 2017	98	2
Present study	92	8

Chart 22: Variations in the Appendicular Artery (AA)



In the present study, the VA was supplied by a single AA, a branch from inferior division of ICA in 92% of the cases and in 8% it was supplied by double AA , one branch from the ICA and other from the PCA. This study coincided with the study of Nirmala Devi and Sudha Seshayyan et al [37].

CONCLUSION

The variations in the Caecum and vermiform Appendix have been great interest to anatomists and surgeon, interventionists and radiologists due to wide clinical and radiological implications. This study was carried out by routine dissection method. The present study provides information of both normal and variant morphology of the Caecum and Vermiform Appendix.

The following conclusions were drawn from the study

- The Caecum was found to be in the Right Iliac Fossa in all the 50 cases.
- The shape of the Caecum was found to be adult type in 42 (84%) specimens, in 6(12%) specimens it was exaggerated type, in 2(4%) specimens it was infantile type.
- The length of the caecum was varying from 4 to 8 cms with a mean length of 5.9 ± 0.99cms.
- The breadth of the caecum was varying from 5 to 8.5 cms with a mean breadth of 7.05 ± 0.90 cms.
- The Vermiform Appendix was found to be in the Right Iliac Fossa, in all the cases.

- In 31 (62%) cases the Vermiform Appendix was found to be in the retrocaecal position. In 16 (32%) cases it was found to be in the pelvic position and in 2 (4%) specimen it was post ileal, in 1(2%) case it was found to be subcaecal in position.

- The length of the Vermiform Appendix was varying from 2.5 cms to 13.6cms with the mean length of 7.5± 3.2cms.

- The external diameter of the Vermiform Appendix at its base was varying from 2.5 mms to 12.5mms with the mean of 7.2mms± 3.25mms.

- The average distance between IleoCaecal Orifice and the Appendicular Orifice was found to be 2.36 ± 0.78 cms, varies from 1.2 to 4.2 cms.

- The MesoAppendix was complete in 34 (68%) specimens, in 16 (32%) specimens in was incomplete.

- The Vermiform Appendix was supplied by a single Appendicular Artery a branch from inferior division of IleoColic Artery in 46(92%) specimens, in 4(8%) specimens it was supplied by double Appendicular Artery from the IleoColic Artery and from the PosteriorCaecal Artery.

Thorough anatomical knowledge about the Caecal and Appendicular Arteries and their variations are important for surgeons

while operating on the Ileocolic region .The details of origin, number and branching pattern of Appendicular Arteries will be useful for the surgeons to use the appendix with its pedicle or as free transplant in many reconstructive microsurgeries. The same knowledge is also helpful in the interpretation of superior mesenteric or ileocolic angiograms by radiologists.

A thorough anatomical knowledge of the variations in the positions of the Caecum and Vermiform Appendix and its blood supply will be helpful for the surgeons and the radiologists during surgical procedure and imaging techniques.

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Introduction

Aim and Objectives

Review of Literature

Embryology

Materials and Methods

Observation

Discussion

Conclusion

Bibliography

MASTER CHART

S.NO	POSITION OF CAECUM				SHAPE OF CAECUM				LENGTH CAECUM (cms)	BREATH CAECUM (cms)	POSITION OF VA (ABDOMEN)				POSITION OF VA (TIP)					LENGTH VA (cms)	EXT DIA VA (mms)	DIS ICO - APO (cms)	MESOAP		AA	
	RIF	LIF	SUB HEP	LUM	FOE	INF	AD	EX			RIF	LIF	SH	LUM	RC	PEL	POI	PI	SC				C	IC	SIN	MORE THAN ONE
1	+	-	-	-	-	-	+	-	5.2	6.3	+	-	-	-	+	-	-	-	-	2.5	6.4	2.2	+	-	+	-
2	+	-	-	-	-	-	+	-	5.1	7.2	+	-	-	-	+	-	-	-	-	6.8	7.6	1.7	-	+	+	-
3	+	-	-	-	-	-	-	+	6.2	6.8	+	-	-	-	-	+	-	-	-	3.2	3.8	3.4	-	+	+	-
4	+	-	-	-	-	-	+	-	5.8	08	+	-	-	-	-	+	-	-	-	10.3	5.3	04	-	+	+	-
5	+	-	-	-	-	-	+	-	4.7	6.9	+	-	-	-	+	-	-	-	-	4.5	4.8	3.4	+	-	+	-
6	+	-	-	-	-	+	-	-	5.2	5.7	+	-	-	-	+	-	-	-	-	5.3	5.2	4.2	+	-	-	+
7	+	-	-	-	-	-	+	-	04	7.8	+	-	-	-	+	-	-	-	-	11.2	3.6	02	-	+	+	-
8	+	-	-	-	-	-	+	-	5.7	6.9	+	-	-	-	-	+	-	-	-	2.8	4.7	2.1	-	+	+	-
9	+	-	-	-	-	-	+	-	08	08	+	-	-	-	+	-	-	-	-	10.5	2.8	02	+	-	+	-
10	+	-	-	-	-	-	-	+	4.4	6.9	+	-	-	-	-	+	-	-	-	9.2	7.7	1.2	+	-	+	-
11	+	-	-	-	-	-	+	-	5.2	5.5	+	-	-	-	+	-	-	-	-	8.4	3.2	02	+	-	+	-
12	+	-	-	-	-	-	+	-	08	7.2	+	-	-	-	+	-	-	-	-	7.3	5.2	2.1	-	+	+	-
13	+	-	-	-	-	-	+	-	5.5	6.8	+	-	-	-	+	-	-	-	-	3.7	3.9	1.9	-	+	+	-
14	+	-	-	-	-	-	+	-	6.5	7.8	+	-	-	-	+	-	-	-	-	4.8	12.2	4.2	+	-	+	-
15	+	-	-	-	-	+	-	-	7.4	08	+	-	-	-	-	+	-	-	-	7.8	3.2	02	+	-	+	-
16	+	-	-	-	-	-	+	-	5.8	6.9	+	-	-	-	+	-	-	-	-	8.6	7.6	2.2	+	-	+	-
17	+	-	-	-	-	-	-	+	08	08	+	-	-	-	+	-	-	-	-	9.6	3.7	2.4	-	+	+	-
18	+	-	-	-	-	-	+	-	5.3	7.2	+	-	-	-	-	+	-	-	-	6.2	5.8	1.7	+	-	-	+
19	+	-	-	-	-	-	+	-	4.1	5.8	+	-	-	-	+	-	-	-	-	13.6	9.8	2.6	+	-	+	-
20	+	-	-	-	-	-	+	-	5.2	5.6	+	-	-	-	+	-	-	-	-	9.2	2.9	02	+	-	+	-
21	+	-	-	-	-	-	+	-	06	7.4	+	-	-	-	-	+	-	-	-	10	3.3	03	+	-	+	-
22	+	-	-	-	-	-	+	-	5.2	07	+	-	-	-	-	+	-	-	-	8.9	9.5	1.2	+	-	+	-
23	+	-	-	-	-	-	+	-	6.2	7.3	+	-	-	-	+	-	-	-	-	4.6	6.2	02	-	+	+	-
24	+	-	-	-	-	-	-	+	5.4	5.2	+	-	-	-	+	-	-	-	-	12.4	5.3	2.3	+	-	+	-
25	+	-	-	-	-	-	+	-	5.1	7.6	+	-	-	-	+	-	-	-	-	3.5	9.8	1.7	+	-	+	-
26	+	-	-	-	-	+	-	-	5.2	6.8	+	-	-	-	+	-	-	-	-	8.2	4.6	04	-	+	+	-
27	+	-	-	-	-	-	-	+	5.2	7.4	+	-	-	-	-	+	-	-	-	3.4	05	2.2	-	+	+	-

RIF-Right Iliac Fossa, LIF- Left Iliac Fossa, SUBHEP- Sub Hepatic, LUM- Lumbar, FOE-Foetal, INF-infantile, AD-Adult, EX-Exaggerated, RC-RetroCaecal, PEL-Pelvic, POI-Post Ileal,PI-Pre Ileal,SC-SubCaecal, VA-Vermiform Appendix, EXT DIA-External Diameter, DIS ICO-APO -Distance between Appendicular orifice and IleoCaecal Orifice, MESOAP- MesoAppendix, C-Complete, IC-InComplete, AA-Appendicular Artery, SIN AA- Single AA, +-Present, – - Absent.

S.NO	POSITION OF CAECUM				SHAPE OF CAECUM				LENGTH CAECUM (cms)	BREATH CAECUM (cms)	POSITION OF VA (ABDOMEN)				POSITION OF VA (TIP)					LENGTH VA (CMS)	EXT DIA OF VA (mms)	DIS ICO-APO (cms)	MESOAP		AA	
	RIF	LIF	SUB HEP	LUM	FOE	INF	AD	EX			RIF	LIF	SH	LUM	RC	PEL	POI	PI	SC				C	IC	SIN	MORE THAN ONE
28	+	-	-	-	-	-	+	-	6.3	7.3	+	-	-	-	+	-	-	-	-	6.4	11.9	2.2	-	+	+	-
29	+	-	-	-	-	-	+	-	6.4	07	+	-	-	-	-	+	-	-	-	5.4	11.4	1.2	+	-	-	+
30	+	-	-	-	-	-	-	+	5.6	7.2	+	-	-	-	+	-	-	-	-	10.6	3.2	2.1	+	-	+	-
31	+	-	-	-	-	-	+	-	6.5	6.9	+	-	-	-	-	+	-	-	-	6.1	03	2.2	+	-	+	-
32	+	-	-	-	-	-	+	-	5.8	8.5	+	-	-	-	+	-	-	-	-	8.2	12.5	2.2	-	+	+	-
33	+	-	-	-	-	-	+	-	6.4	7.3	+	-	-	-	-	+	-	-	-	11.8	4.2	2.1	+	-	+	-
34	+	-	-	-	-	-	+	-	7.6	08	+	-	-	-	-	+	-	-	-	8.8	8.4	1.3	+	-	+	-
35	+	-	-	-	-	-	+	-	5.2	7.6	+	-	-	-	+	-	-	-	-	4.4	7.5	1.2	+	-	+	-
36	+	-	-	-	-	-	+	-	6.5	08	+	-	-	-	+	-	-	-	-	4.2	12.5	2.3	+	-	+	-
37	+	-	-	-	-	-	+	-	5.2	5.4	+	-	-	-	+	-	-	-	-	10	9.4	1.2	-	+	+	-
38	+	-	-	-	-	-	-	+	6.5	6.6	+	-	-	-	-	+	-	-	-	9.3	10.5	1.4	+	-	+	-
39	+	-	-	-	-	+	-	-	5.2	7.5	+	-	-	-	+	-	-	-	-	4.2	9.3	1.2	+	-	+	-
40	+	-	-	-	-	-	+	-	7.8	8.5	+	-	-	-	+	-	-	-	-	2.5	12.5	1.8	+	-	+	-
41	+	-	-	-	-	-	+	-	05	05	+	-	-	-	-	+	-	-	-	6.8	9.8	2.2	+	-	-	+
42	+	-	-	-	-	-	+	-	5.8	7.5	+	-	-	-	+	-	-	-	-	13.6	12	1.6	-	+	+	-
43	+	-	-	-	-	-	+	-	5.5	7.9	+	-	-	-	+	-	-	-	-	13	11.6	03	+	-	+	-
44	+	-	-	-	-	-	+	-	7.5	7.8	+	-	-	-	-	-	+	-	-	6.2	8.8	02	+	-	+	-
45	+	-	-	-	-	-	+	-	5.1	6.9	+	-	-	-	-	+	-	-	-	12.2	5.3	1.5	+	-	+	-
46	+	-	-	-	-	-	-	+	6.1	7.5	+	-	-	-	+	-	-	-	-	3.4	12.2	02	+	-	+	-
47	+	-	-	-	-	-	+	-	7.2	5.8	+	-	-	-	+	-	-	-	-	6.3	8.5	2.4	-	+	+	-
48	+	-	-	-	-	-	+	-	6.2	6.8	+	-	-	-	-	+	-	-	-	10	6.4	1.4	+	-	+	-
49	+	-	-	-	-	-	+	-	6.7	8.5	+	-	-	-	+	-	-	-	-	12	4.4	1.2	+	-	+	-
50	+	-	-	-	-	-	+	-	5.4	5.3	+	-	-	-	+	-	-	-	-	4.9	11.8	2.2	+	-	+	-

RIF-Right Iliac Fossa, LIF- Left Iliac Fossa, SUBHEP- Sub Hepatic, LUM- Lumbar, FOE-Foetal, INF-infantile, AD-Adult, EX-Exaggerated, RC-RetroCaecal, PEL-Pelvic, POI-Post Ileal, PI-Pre Ileal, SC-SubCaecal, VA-Vermiform Appendix, EXT DIA-External Diameter, DIS ICO-APO -Distance between Appendicular orifice and IleoCaecal Orifice, MESOAP- MesoAppendix, C-Complete, IC-InComplete, AA-Appendicular Artery, SIN AA- Single AA, +-Present, – - Absent.

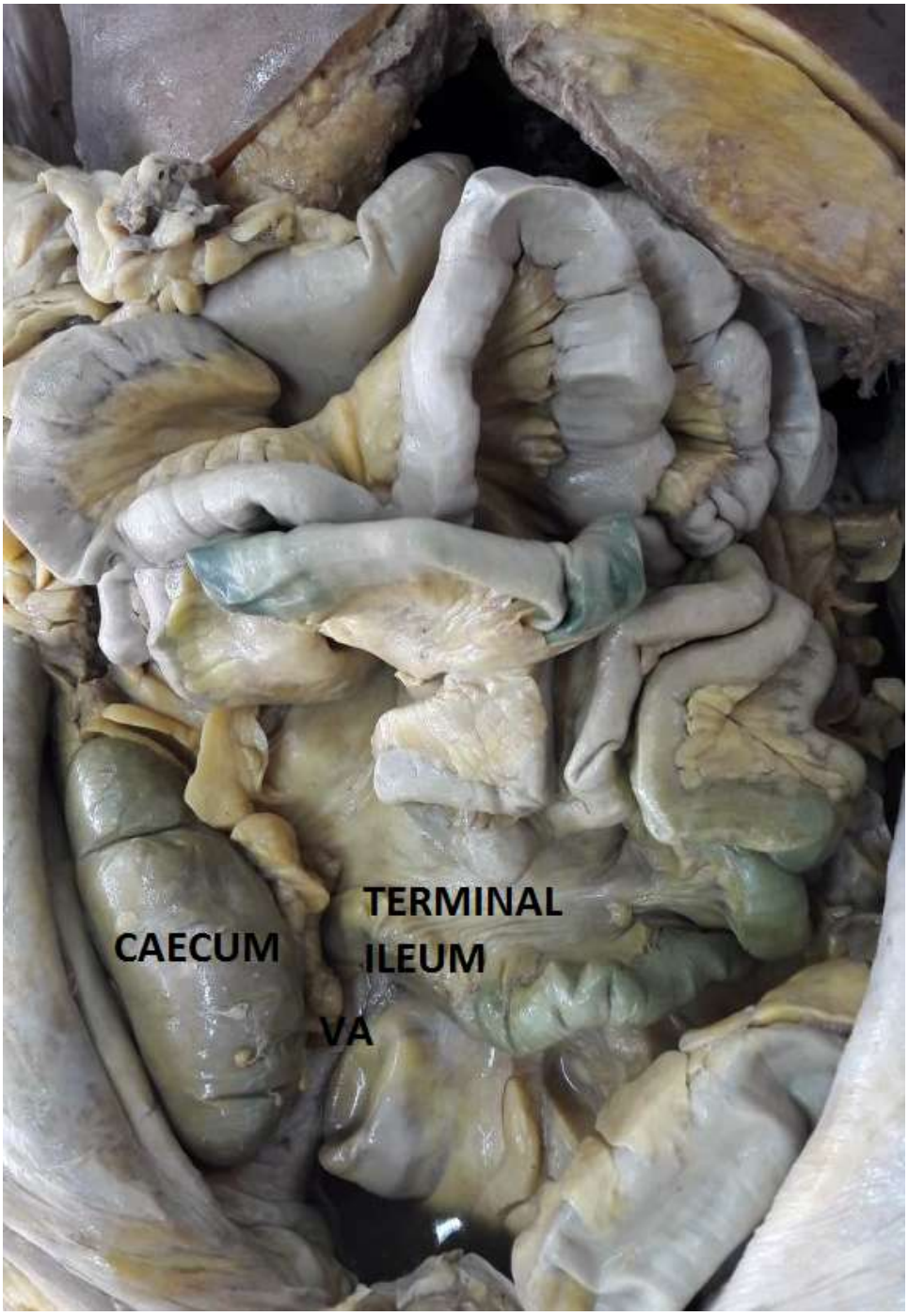


Fig 1: Position of the Caecum- Right Iliac Fossa

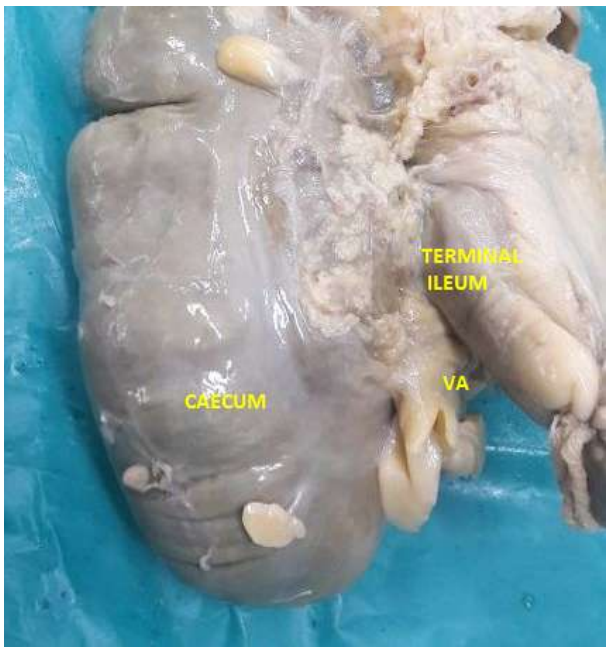


Fig 2 A: Shape of the Caecum- Adult shape

Fig 2 B: Shape of the Caecum- Exaggerated shape

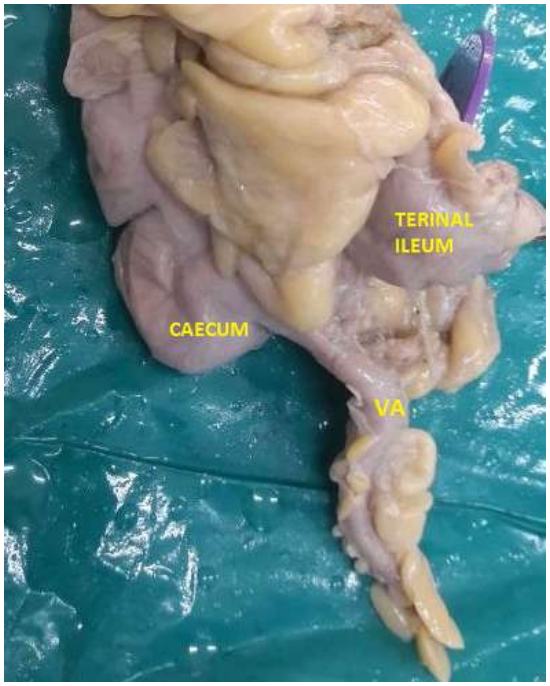


Fig 2 C: Shape of the Caecum- Infantile shape

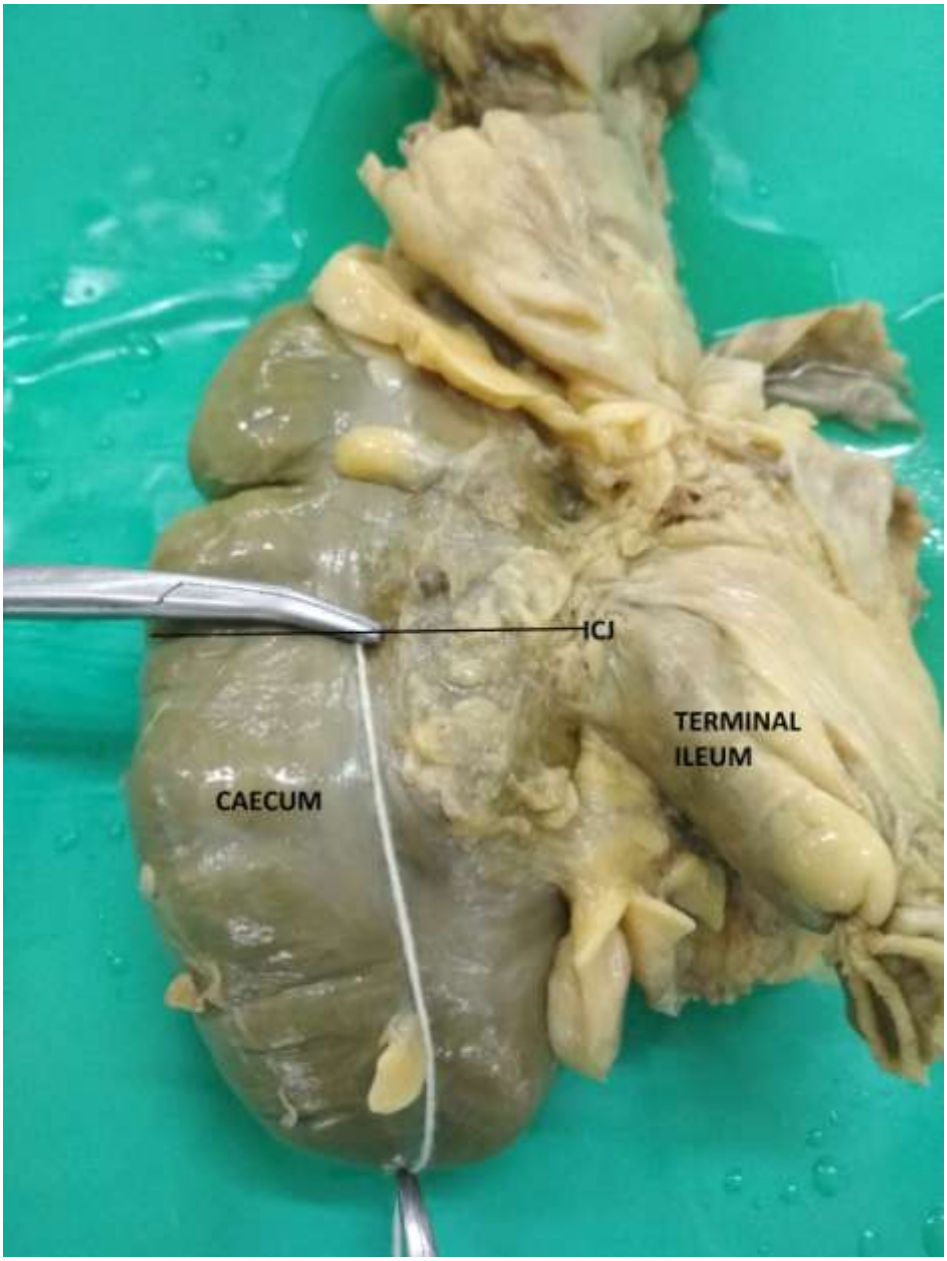


Fig 3: Length of the Caecum

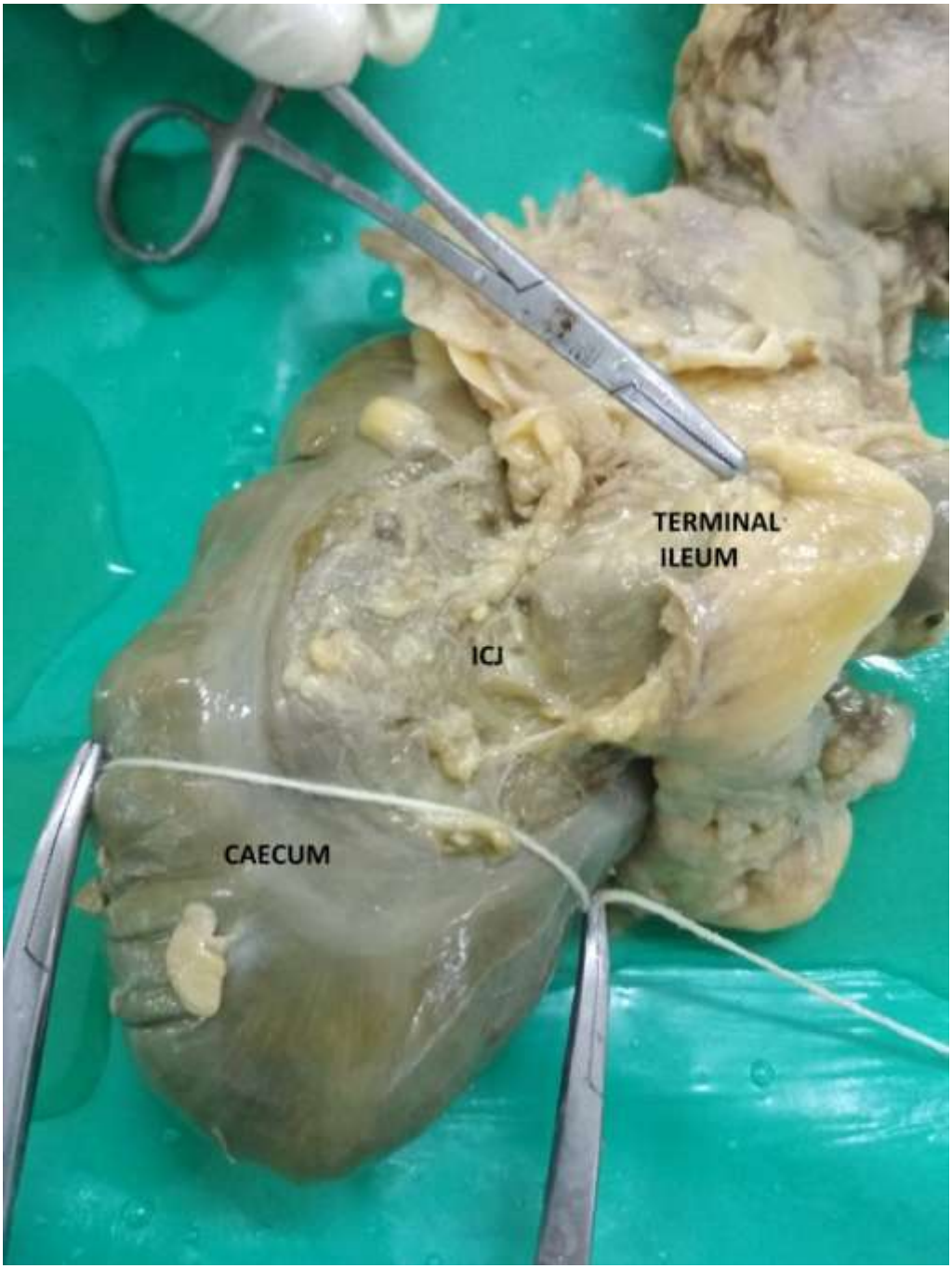


Fig 4: Breadth of the Caecum

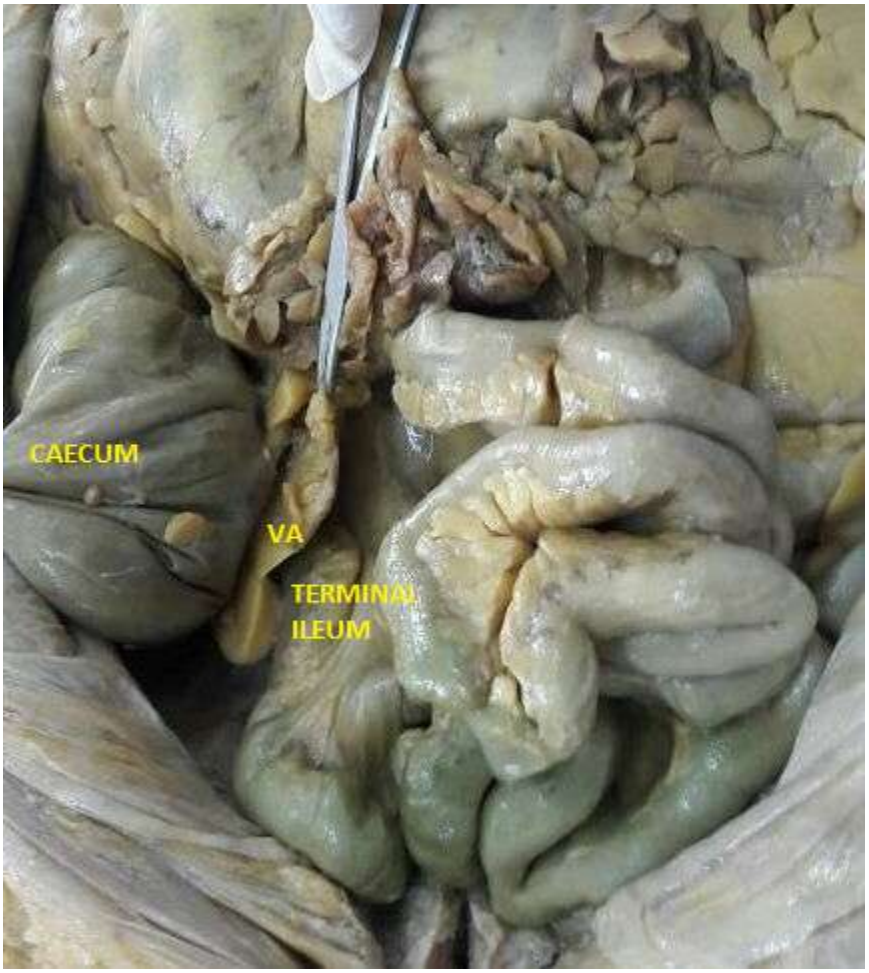


Fig 5: Position of the Vermiform Appendix- Right Iliac Fossa

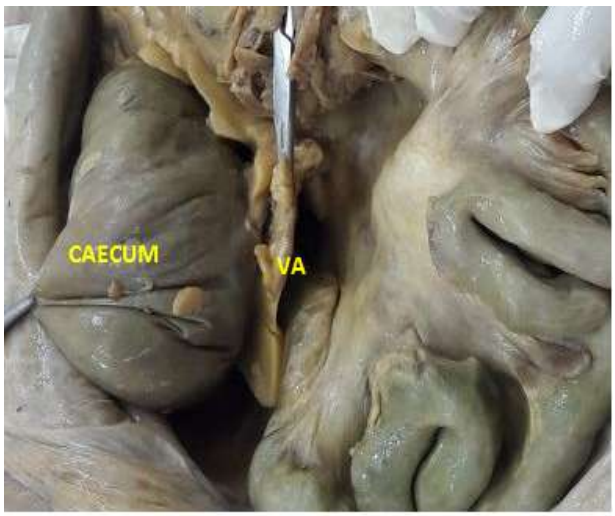


Fig 6 A: Position of the Vermiform Appendix-Retrocaecal

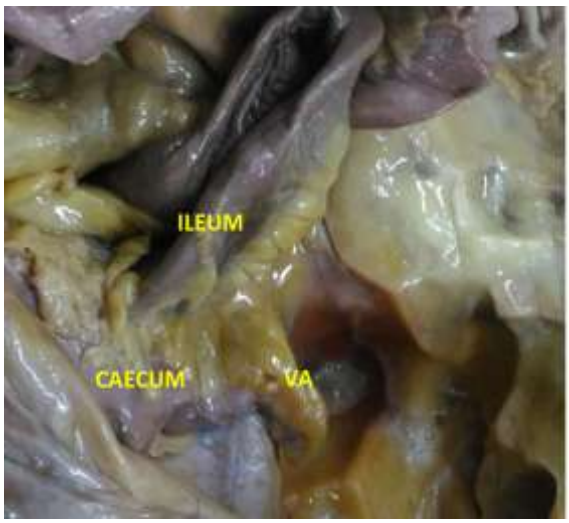


Fig 6 B: Position of the Vermiform Appendix- Pelvic

Fig 6 C: Position of the Vermiform Appendix-Post Ileal

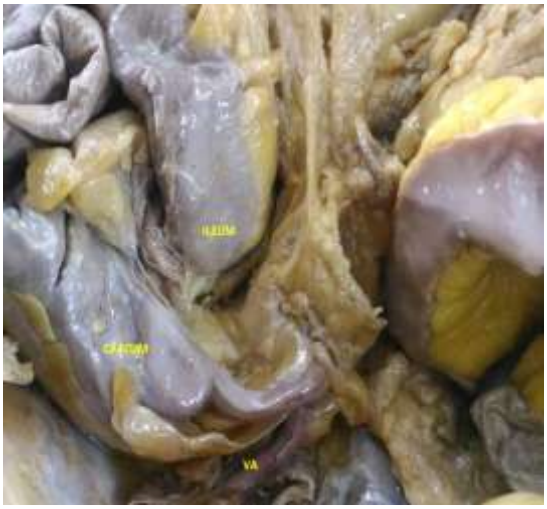


Fig 6 D: Position of the Vermiform Appenix- Subcaecal

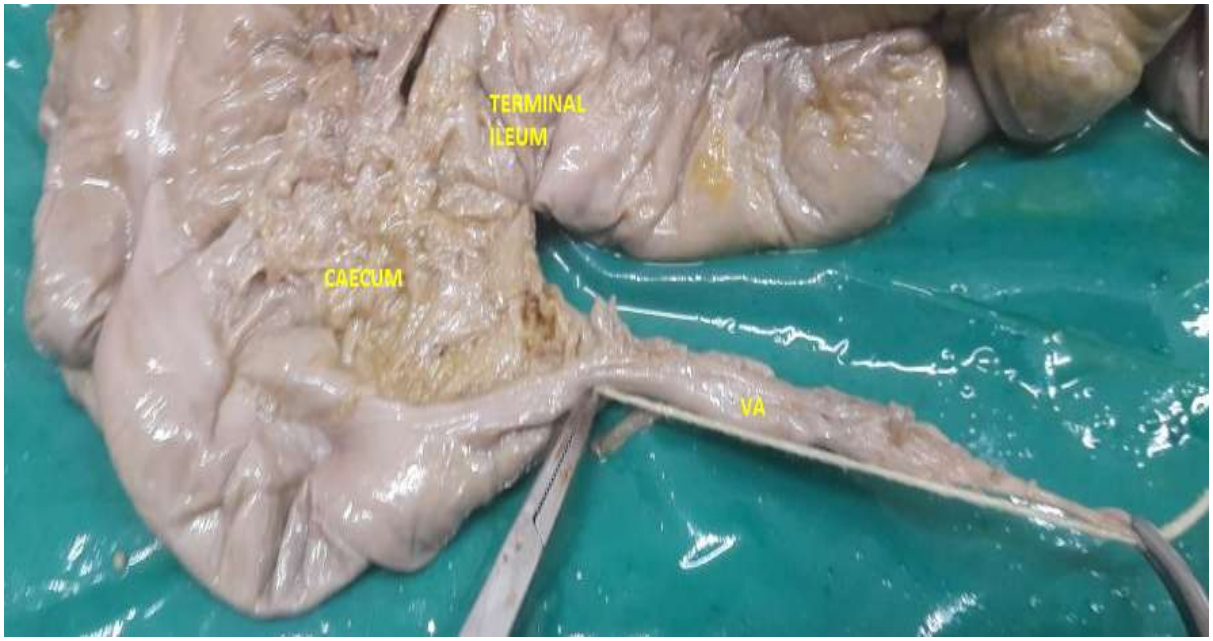


FIG 7: Length of the Vermiform Appendix

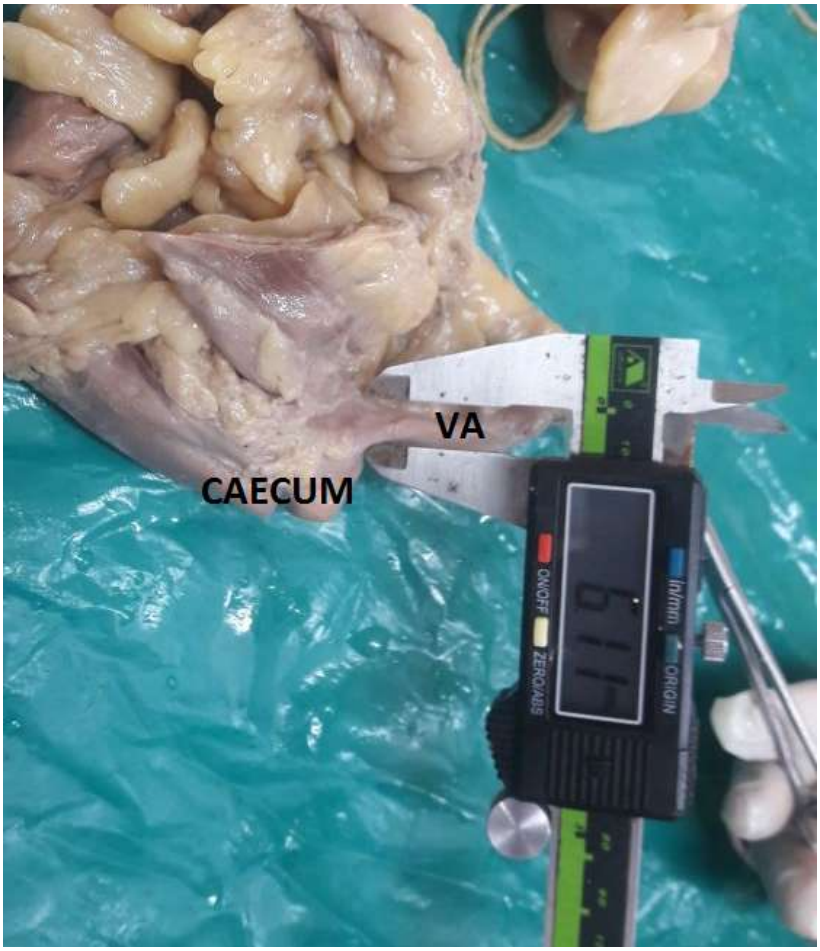


Fig 8A: External Diameter of the Vermiform Appendix

Fig 8B: Vernier Calipers

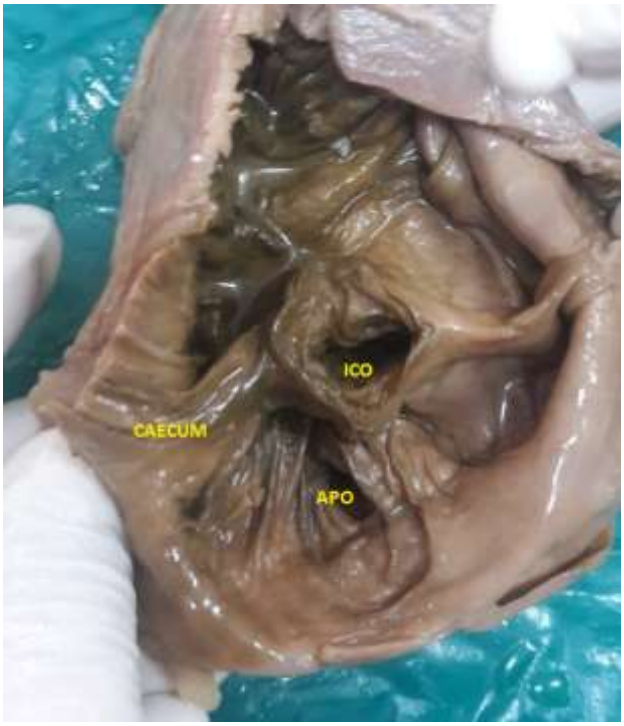


Fig 9A: Interior of the Caecum

Fig 9 B: Distance between Appendicular Orifice and IleoCaecal Orifice

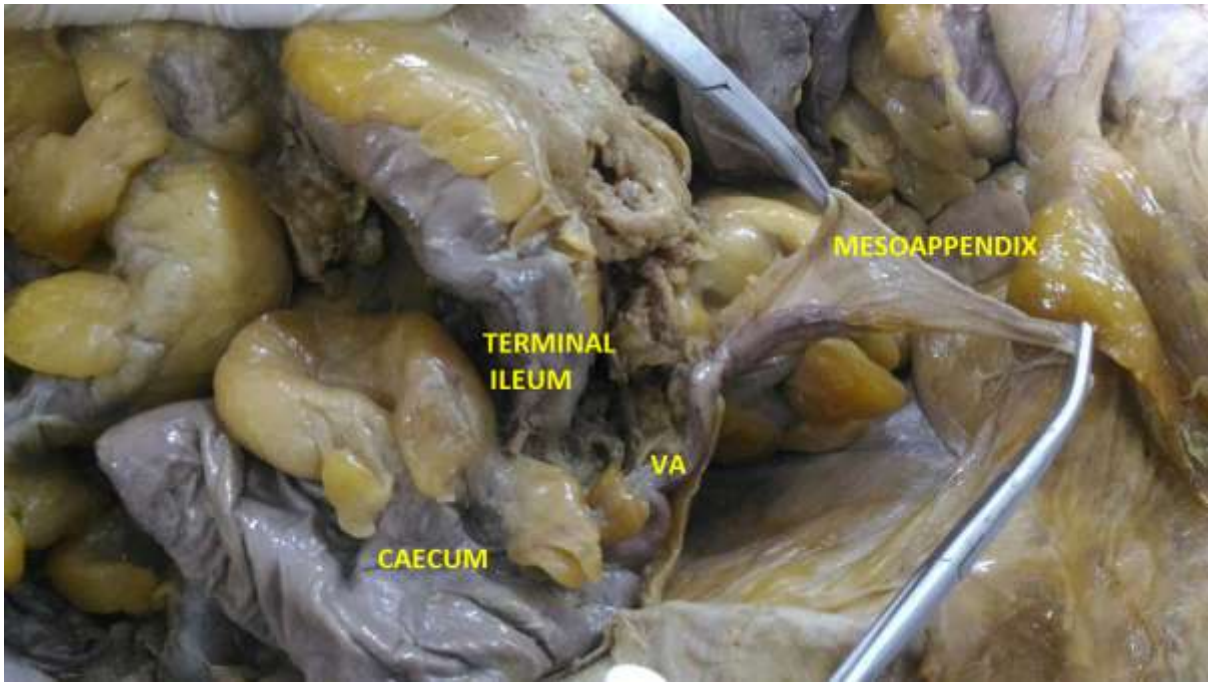
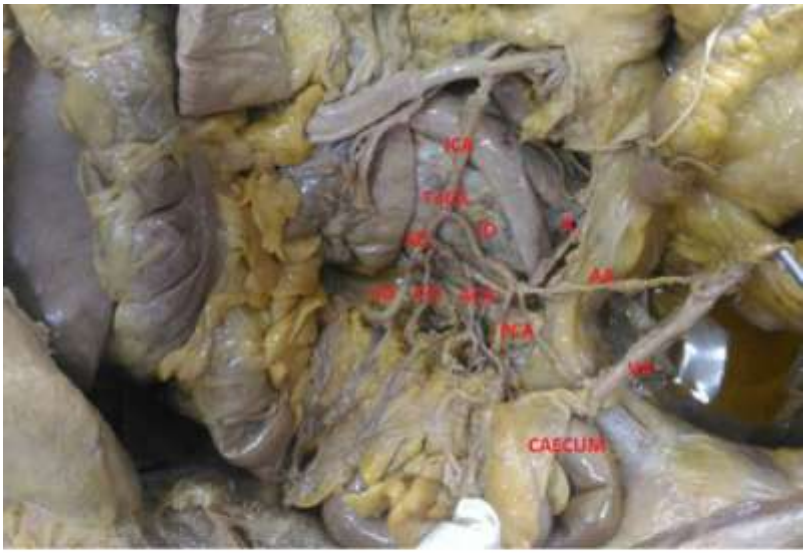


Fig 10: MesoAppendix



VA- VERMIFORM APPENDIX, ICA- ILEOCOLIC ARTERY, T-ICA-TRUNKMOF ICA, SD-UPERIOR DIVISION OF ICA, ID- INFERIOR DIVISION OF ICA, ACA- ANTERIOR CAECAL ARTERY, PCA- POSTERIOR CAECAL ARTERY, AA- APPENDICULAR ARTERY, IL-ILEAL BRANCH OF ICA, CO- COLIC BRANCH OF ICA.

Fig 11A: Blood supply of the Vermiform Appendix

ICA-IEOCOLIC ARTERY, ID- INFERIOR DIVIION OF ICA, SD- SUPERIOR IVIION OF ICA, ACA- ANTERIOR CAECAL ARTERY, PCA- POSTERIOR CAECL ARTERY, AA-APPENDICULAR ARTERY, VA- VERMIFORM APPENDIX , ICV- ILEOCOLIC VEIN

Fig 11B: Blood supply of the Vermiform Appendix